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Proceedings of the March 2000 Newfoundland Region Salmonid Stock Assessment Meeting

November 1999 and March 2000
St. John's, Newfoundland

J. B. Dempson, Chairperson

Fisheries and Oceans Canada
Science, Oceans, and Environment Branch
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ABSTRACT

The seventh annual Salmonid Stock Assessment Meeting for the Newfoundland Region was held in St. John's, Newfoundland, November 3, 1999, and March 6-9, 2000. The general status of salmon stocks, based on data compiled during 1999, was reviewed along with detailed assessments on 26 individual rivers. Oceanographic conditions in the northwest Atlantic were also summarized. An overview of commercial landings, biological characteristics, tag recovery and ocean migrations of northern Labrador Arctic charr were presented. A summary of the current information on rainbow trout occurrences in Newfoundland rivers was tabled. This report summarizes each of the various working papers that was presented, provides an account of the general status of stocks and subsequent advice conveyed to Fisheries Managers, and presents individual summary sheets for the various stocks that were assessed.

RÉSUMÉ

La septième rencontre annuel d'Évaluation des stocks de salmonidés dans la Région de Terre-Neuve a eu lieu à St. John's (Terre-Neuve) le 3 novembre 1999 et du 6 au 9 mars 2000. Les participants ont procédé à un examen de l'état général des stocks de saumon, fondé sur les données compilées en 1999, ainsi qu'à des évaluations détaillées de 26 rivières individuelles. Les conditions océanographiques dans le nord-ouest de l'Atlantique ont aussi fait l'objet d'une synthèse. Une vue d'ensemble des débarquements commerciaux, des caractéristiques biologiques, des captures de spécimens étiquetés et des migrations océaniques de l'ombre chevalier du nord du Labrador a été présentée. Un sommaire de l'information actuellement disponible sur la présence de truite arc-en-ciel dans les rivières de Terre-Neuve a été soumis. Le rapport résume chacun des divers documents de travail présentés à la rencontre, donne un aperçu de l'état général des stocks et conseille aux gestionnaires des Pêches des mesures à prendre. Il contient aussi des feuilles de synthèse des évaluations des divers stocks.

INTRODUCTION

The seventh annual Newfoundland Region Salmonid Stock Assessment meetings were held in St. John's, Newfoundland on November 3, 1999, and from March 6 to 9, 2000. The November meeting, attended by five DFO Science staff, was held to provide a preliminary review of the general status of Newfoundland salmon stocks and to address specific issues raised by Fisheries Management. These issues related to: a) the river classification system; b) environmental protocols; c) impacts related to the possible retention of large salmon in subsequent years; and d) the Exploits River management plan. Detailed stock assessments were tabled at the March 2000 meeting. In addition to Department of Fisheries and Oceans (DFO) Scientific staff, the March meeting also included representatives from: Fisheries Management Branch, the Department of Forest Resources and Agrifoods, Inland Fish and Wildlife Division, Government of Newfoundland and Labrador, Parks Canada, and Memorial University of Newfoundland.

This report contains a synopsis of the advice provided to Fisheries Management on the general status of Newfoundland and Labrador salmon stocks, along with summaries of each of the working papers presented at the March 2000 assessment meetings. Any concerns or comments registered during the discussions are also included. Summary sheets for each of the stocks, and an overall summary table of the status of all stocks, is appended.

Complete details of the data and methodologies used in the assessments are published in the Department of Fisheries and Oceans Canadian Stock Assessment Secretariat Research Document series, while the overall report on the status of stocks is contained in Stock Status Report D2-01 (2000), Newfoundland & Labrador Atlantic Salmon Stock Status for 1999.

A copy of the agendas for the November 1999 and March 2000 meetings are provided in Appendices 1 and 2, respectively. Appendix 3 summarizes the list of participants, working papers are provided in Appendix 4. Appendix 5 is a generalized summary of the status of stocks while individual stock summary sheets are included in Appendix 6.

ADVICE TO FISHERIES MANAGEMENT

A summary of the advice provided to Fisheries Management Branch in November 1999 was based upon preliminary data derived from those rivers monitored for smolts and adult salmon, and inferences on angling catch statistics from some Labrador stocks, as follows:

General Stock Status of Atlantic Salmon in Labrador, SFAs 1 & 2 - 1999

- Available data for stock assessment in Labrador in 1999 comes from three counting fences (English River, Big Brook, and Southwest Brook-Paradise River), a mark-recapture estimate of population size from Paradise River, angling catch statistics and gauging station information from Eagle River.

- Water levels in most rivers in 1999 were above average, whereas in 1998 water levels were considerably below average.

- Based on preliminary catch statistics, catch rate in SFA 1 was slightly lower than in 1998, higher than the 1992-97 mean, but lower than observed in 1994 and 1995.

- Catch rate in SFA 2 was slightly higher than in 1998, higher than the 1992-97 mean, but lower than in 1994 and 1995.

- Differences in catch rates observed in 1999 compared to 1998 could be related to lower catchability of salmon due to poorer angling conditions and population size in freshwater may have been much higher, as reported by many local residents.

- Analysis of data from Sand Hill River indicates that there is no relationship between angling catch rates and numbers of salmon in the river. Thus, changes in angling catch rates are not necessarily indicative of changes in population size of salmon, at least not on Sand Hill River. Inclusion of information on angling conditions such as the effects of varying water levels, which were not incorporated into the analysis, may improve the relationship.

- Three counting facilities were operated in Labrador in 1999 at Southwest Brook (Paradise River), Big Brook, and English River. Counts, while being low overall, improved considerably over values for previous years. Southwest Brook count increased by 250% in 1999 compared to 1998 while Big Brook increased by 33% over 1997 values. This was the first year that salmon were counted at English River.

- Mark-recapture estimate for Faradise River was about 4,800 salmon.

- Higher population sizes may be due to closure of the commercial fisheries and/or improved natural survival rates.

- Based on the estimated numbers of spawners in previous years, there may be considerable improvements in returns of salmon to SFAs 1 & 2 rivers in 2000, assuming the sea survival (although unknown for Labrador stocks) remains at present levels.

General Stock Status of Atlantic Salmon in Newfoundland, SFAs 3-14A - 1999

- Available data are: enumeration of adult salmon in 18 rivers; enumeration of smolts in 6 rivers; mark-recapture estimate of adult returns in 1 river (Humber); snorkelling survey estimates of adult returns in 5 rivers (in Bay St. George).

- Run timing of small and large salmon in 1999 ranged from early to average (1992-98), but for some rivers (Campbellton, Terra Nova, Highlands, Pinchgut, and Western Arm Brook), low water levels and high water temperatures beginning in late June and early July delayed entry of sizeable portions of runs until as late as early to mid-August.

Northeast and eastern (SFAs 4 and 5)

- Total returns of small salmon in 1999 were similar to those of 1998 in 4 (Exploits, Campbellton, Gander, and Terra Nova) out of 7 rivers, while the remainder showed decreases (Indian Bay, Middle Brook, and Northwest); returns increased over or were similar to the moratorium mean 1992-98 for 4 rivers (Exploits, Campbellton, Gander, and Middle Brook) but decreased in 2 (Terra Nova and Northwest).

- Total returns of large salmon in 1999 increased over or were similar to 1998 and the 1992-98 mean in 4 (Exploits, Campbellton, Gander, Indian Bay) out of 7 rivers but decreased in 3 (Middle Brook, Terra Nova, Northwest).

- Proportions of large salmon in total returns in 1999 were the highest since 1992 for Gander River and the second highest for Campbellton River.

South (SFAs 9-11)

- Total returns of small salmon in 1999 increased over or were similar to those of 1998 in 2 (Northeast Brook, Trepassey and Little) out of 5 rivers while the remaining rivers (Rocky, Northeast, Placentia, and Conne) showed declines; returns increased or remained the same relative to the 1992-98 mean in 3 rivers (Northeast Brook, Trepassey, Rocky, and Little) and decreased in 2 (Conne and Northeast, Placentia).

- Total returns of large salmon in 1999 increased or remained the same compared to 1998 in 2 (Northeast Brook, Trepassey and Little) out of 5 rivers and decreased in 3 (Rocky, Northeast, Placentia, and Conne); all 5 rivers increased over the 1992-98 mean.

- Proportions of large salmon in total returns in 1999 were the highest of the moratorium years in Northeast River, Placentia and Conne River and among the highest in the other rivers.

Southwest (SFA 13)

- Total returns of small salmon to Highlands River in 1999 increased over 1998 but remained below the mean for 1992-98; returns to Pinchgut Brook were similar to 1998 and above the mean.

- Total returns of large salmon to Highlands River in 1999 decreased from 1998 and the mean for 1992-98; returns to Pinchgut Brook were similar to 1998 and above the mean.

- Total returns of small and large salmon in 1999, estimated from snorkelling surveys, showed marked improvements in 3 (Robinsons, Fischells, and Flat Bay) of 5 rivers in Bay St. George.

- A preliminary estimate of total returns of small salmon to Humber River in 1999 indicates the population to be higher than in 1998 and there is a very high likelihood that conservation requirement was exceeded.

Northwest (SFA 14A)

- Total returns of small salmon in 1999 increased over 1998 in 1 (Lomond) out of 3 rivers but decreased in the remaining 2 (Torrent and Western Arm); 2 rivers (Lomond and Torrent) decreased from the 1992-98 mean while Western Arm Brook showed an increase.

- Total returns of large salmon in 1999 decreased from 1998 in all three rivers and only Lomond River showed an increase over the 1992-98 mean.

General comments

- Total returns of small salmon to northwest, and northeast and east coast rivers in 1999 were similar to or declined somewhat from the mean for the moratorium years 1992-98. This is in spite of greatly increased spawning escapements during the moratorium years, which contributed to returns in 1999.

- Northeast Brook, Trepassey and Conne River, both south coast rivers, had returns of small salmon in recent years that were lower than average returns for the 5 years prior to the commercial fishery moratorium. For the first time since the

moratorium, total returns of small salmon to Northeast River, Placentia fell below values observed prior to the moratorium.

- Returns of large salmon to some rivers in 1999 were either the highest on record or among the highest (Exploits, Gander, and Campbellton) while for other rivers (Middle Brook, Rocky, Northeast Placentia, Highlands, Torrent and Western Arm), substantial declines from 1998 occurred. It should be noted however, that in most instances where there were declines in 1999, they were in relation to record or near record returns in 1998. Total returns of large salmon remained above the mean for 1992-98 in most cases.

Marine survival and Smolt production

- ***Marine survival*** from smolts to small salmon returns in 1999, was either *similar* to (Northeast Brook Trepassey) or *higher* (Campbellton, Conne, Rocky, Highlands) than 1998, with one exception. Marine survival at WAB *decreased* by about 15% from last year.

- With the exception of Highlands River, all other rivers had marine survival rates that were 8 to 23% *less* than the previous 5-year (1994-98) average survival.

- ***Smolt production*** in five of 6 rivers *decreased* in 1999 from 6% (Campbellton) to 29% (Rocky). Smolt production at Highlands *increased* by 62% over the previous year, but is still lower than historic information.

- Smolt production has fallen 22 to 49% over the past two years (since 1997) in all monitored rivers but Highlands.

- By comparison with the 1994-98 mean, smolt production has either been the same (Northeast Trepassey, Highlands) or from 6 to 29% *less* than average.

SUMMARY OF PRESENTATIONS

A total of 24 working papers was presented; 20 on Atlantic salmon, one each on Arctic charr and rainbow trout, and two papers focused on environmental conditions in the northwest Atlantic. Papers were presented that examined the status of Atlantic salmon in relation to conservation requirements for 22 rivers in insular Newfoundland (plus three sections for Exploits River), while two Labrador rivers were assessed relative to conservation requirements. It is noted, however, that conservation requirements for the Labrador rivers may not be appropriate, and are currently used as a reference level. Two stocks (Little River, SFA 11, and English River, SFA 1) were reviewed, but not in relation to conservation requirements. Collective results of the stock evaluations are

summarized in Appendix 5, with elements of results for individual rivers provided in the Summary Sheets (Appendix 6). A map showing the SFAs of the Newfoundland Region, the individual rivers assessed, and percent of conservation egg requirements achieved for each river in 1999 is provided in Figures 1 and 2. The paper on Arctic charr presented information on commercial fishery landings for 1999 as well as historical landings and an update of tag recovery and ocean migration information compiled over the past 25 years. The paper on rainbow trout summarized current information on occurrences of this species in Newfoundland rivers.

RESEARCH RECOMMENDATIONS

Accurate estimates of salmon abundance are fundamental and essential to determine the status of salmon stocks and for the provision of advice to support current management strategies. A network of geographically distributed rivers annually monitored for smolt and adult salmon production is necessary to derive estimates of marine and freshwater survival, develop stock-recruitment relationships, and understand how fish populations respond to exploitation. While the reasons for the varying marine survival may be difficult to explain in the absence of an intensive marine program, marine survival rates when viewed for trends are valuable especially for management purposes and to the general public.

Specific recommendations are as follows:

1. At a minimum, all fish monitoring facilities and mark-recapture projects carried out in 1999 should be continued in 2000 and maintained in subsequent years. These projects form the long-term core data for providing stock assessment advice.

2. Further investigations on smolt and adult salmon production should be conducted on south coast salmon populations to determine why these stocks did not improve with the closure of the commercial salmon fishery in 1992.

3. Investigations should be initiated to substantiate and quantify the importance of the fall run of large multi-sea winter (MSW) salmon that spawns in the lower part of Humber River.

4. Studies to better understand the impact of predation by cod, seals, and sea birds on migrating smolts and adult salmon should be expanded. Near shore or in-river predation may be one of the causes of the current low survival of salmon.

5. Research is required on the effect of hook-and-release fishing on salmon survival and spawning success. Given the limitations of past experiments and their absence in Newfoundland and Labrador, appropriate experiments should be designed and projects carried out to determine if the hook-and-release mortality rates currently used in the regional stock assessments are valid.

6. Investigations are required to assess the potential impacts on wild salmonid stocks of the apparent large numbers of escaped-farmed salmonids in Bay d'Espoir. A series of index stations needs to be established and annually surveyed to document the distribution and relative abundance of escaped farmed fish in Bay d'Espoir and in Conne River and adjacent watersheds. This would provide a means by which the new containment practices in the aquaculture industry can be monitored. The index stations would also furnish baseline information necessary to examine potential impacts on wild fish populations.

7. The wide geographic distribution of rivers on the west and south coasts on Newfoundland where rainbow trout were observed in 1999 is of concern. A study is required to determine the origin of these fish and if they are successfully spawning.

8. The salmon angling Licence Stub Return System implemented in 1994 has the potential to be a consistent and reliable method of data collection. Additional improvements to the system, such as verification with other methods and by increasing angler response rates, are required. Harvest and effort statistics provide a means for evaluating the effectiveness of management measures and for assessing the status of stocks, which is vital to the management of Atlantic salmon.

9. Studies that examine the influence of both freshwater and marine environmental conditions on the survival and production of Atlantic salmon should be continued and expanded. Investigations of this nature could have increasing importance in the context of various climate change scenarios and impacts on fisheries resources.

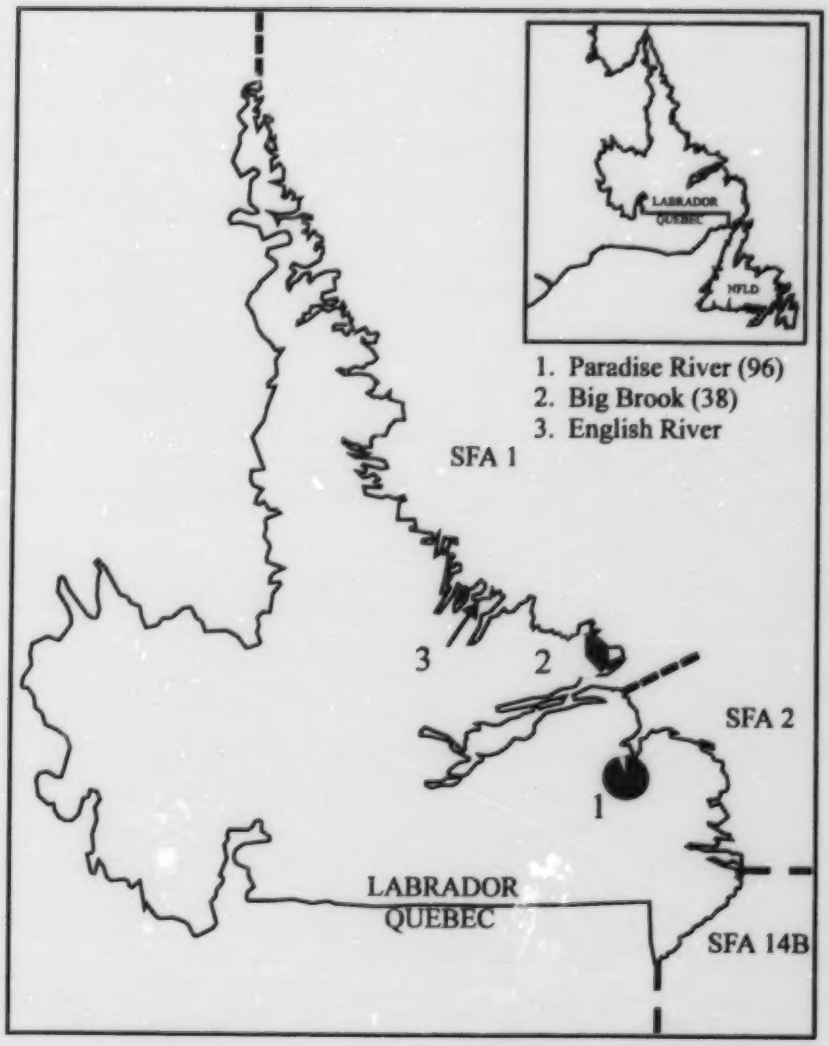

Figure 1. Map illustrating the location of the Salmon Fishing Areas of Labrador, along with salmon rivers assessed in 1993. The black portion of the circle and the

number in parentheses indicates the percentage of the conservation reference level achieved in 1999. English River (map index 3) was not assessed relative to conservation spawning requirements.

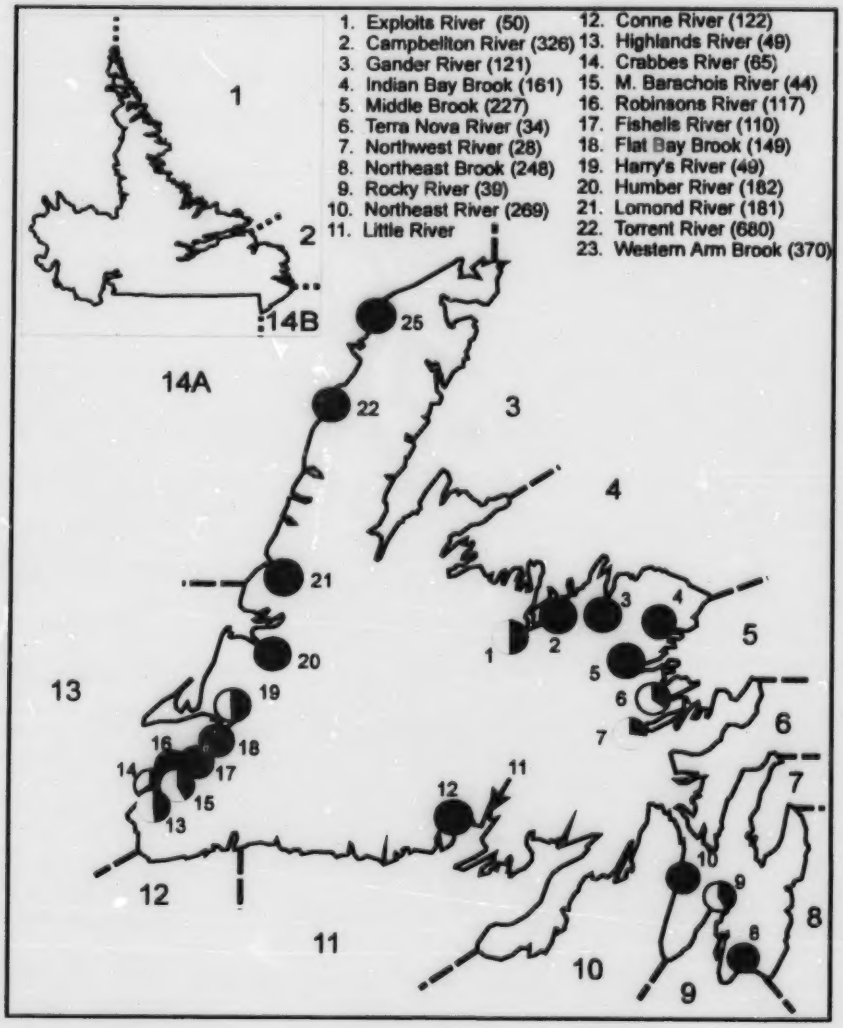

Figure 2. Map illustrating the location of the Salmon Fishing Areas of Newfoundland, along with various salmon rivers assessed relative to their conservation requirements. The black portion of the circle and the numbers in parentheses indicate the percentage of the egg conservation requirement achieved for each river in 1999. Little River (map index 11) was not assessed relative to conservation spawning requirements.

SUMMARIES OF PAPERS PRESENTED DURING ASSESSMENT MEETINGS

Oceanographic conditions in NAFO Subdivisions 3Pn and 3Ps during 1999 with comparisons to the long-term (1961-1990) average

Authors: E. Colbourne

Summary: Oceanographic data from NAFO subdivisions 3Pn and 3Ps during 1999 are examined and compared to the long-term (1961-1990) average. The data are presented in several ways, as vertical transects across the major banks and channels, horizontal bottom maps, time series of areal extent of bottom water in selected temperature and salinity ranges and as time-series of temperature anomalies at standard depths. Time series of temperature anomalies in the 3Ps St. Pierre Bank area show anomalous cold periods in the mid-1970s and since the mid-1980s, similar to conditions on the continental shelf along the East Coast of Newfoundland. The most recent cold period, which started around 1984, continued to the early 1990s with temperatures up to 1°C below average over all depths and up to 2°C below the warmer temperatures of the late 1970s and early 1980s in the surface layers. Temperatures in deeper water off the banks show no significant trends. Since 1991, temperatures have moderated in some areas from the lows experienced from the mid-1980s and early 1990s but negative temperature anomalies continued over large areas of the banks into the spring of 1995. During 1996 temperatures started to moderate, decreased again during the spring of 1997 and returned to more normal values during 1998. Temperatures during 1999 continued to warm and were above normal over most of the water column and near bottom. An analysis of the areal extent of subzero °C bottom water covering the banks shows a dramatic increase since the mid-1980s, very low values in 1998 and a complete disappearance in 1999. The areal extent of bottom water with temperatures above 1°C on the banks was about 50% of the total area during 1998 the first significant amount since 1984 and it increased further to about 70% during 1999. The salinity data clearly shows a change in water mass characteristics during the last 2 years, compared to conditions that prevailed during the first half of the 1990s. The areal extent of the relatively saltier water (> 32.5) on the banks increased by approximately 40% during this time, indicative of a shift from the cold-fresh conditions of the late 1980s and first half of the 1990s on the Newfoundland Continental Shelf to warmer-saltier conditions.

Oceanographic conditions in NAFO Divisions 2J 3KLMNO during 1999 with comparisons to the long-term (1961-1990) average

Authors: E. Colbourne

Summary: Oceanographic observations from Hamilton Bank on the Southern Labrador Shelf to the Southern Grand Bank on the Newfoundland Shelf during 1999 are presented referenced to their long-term (1961-1990) means. Temperatures at Station 27 ranged from 0.25° to 1°C above normal during the winter months over most of the water column. The spring warming of the water column in the inshore Newfoundland Region began about 2 weeks earlier than normal and maximum summer surface temperatures reached a near record high of 15°C. As a result temperatures were over 2°C above normal at the surface during June and July. Bottom temperatures throughout the year ranged from 0.25° to 0.5 °C above normal. Salinities at Station 27 were above normal during the winter months and below normal during the rest of the year. During the summer and fall of 1999 the cross-sectional area of sub-zero °C water (CIL) off Bonavista, Hamilton Bank and on the Grand Bank decreased over 1998 values continuing the below normal trend established in 1995. Bottom temperatures on the Northern Grand Bank during the spring of 1999 were up to 1°C above average and over the central and Southern Grand Bank they were up to 1-3°C above the long-term average. During the fall bottom temperatures from Hamilton Bank to the southern Grand Bank were significantly above normal. The area of sub-zero °C water covering the bottom on all major banks in the Newfoundland Region during the fall, and on the Grand Banks during spring, had decreased to near 0%. In general, during 1999 ocean temperatures were above normal over most areas continuing the trend established in 1996. The main exception during 1999 was the colder-than-normal temperature anomaly associated with the Labrador Current which was evident in the standard transect data off eastern Newfoundland during the summer months and at Station 27 by early fall.

Comparison of small and large salmon (*Salmo salar* L.) in angling catch data for Labrador

Authors: D. G. Reddin

Summary: Angling data was compared to counting fence data for Sand Hill River, Labrador to determine if the angling data is an accurate measure and/or index of the percentage of large salmon (or corresponding small salmon) in Labrador rivers. Comparison of the numbers of small and large salmon and differences in percent large salmon indicate that angling data is not a precise measure of large salmon nor its percentage in a river. The lack of correlation between the numbers of small and large salmon in the recorded angling data compared to the counting fence suggests that angling data may not even be a suitable index of the percent large salmon (or corresponding small salmon) in a river. The significant correlation between the percent large salmon at the Sand

Hill River counting fence compared to percent large in the angling data is probably spurious given the lack of correlation of the corresponding large and small salmon correlations.

Comments:

1. Problems with using angling data as indices of abundance and proportions of small/large salmon can be due to many factors including catchability of small and large salmon due to their different run timing, data is absent from camps when camp is non-operational which may have little to do with presence or abundance of salmon, effect of various management plans which have reduced angling catches over the time period of data collection (1974-99), hook-and-release data, and variation in exploitation rates of small and large salmon.

Recommendations:

1. Don't use angling data as an index or measure of percent large (or corresponding small) salmon in rivers of Labrador.

The stock status of Atlantic salmon (*Salmo salar* L.) in Paradise River, Labrador in 1999

Authors: D. G. Reddin, P. B. Short, R. Johnson and J. Bird

Summary: In collaboration with the Sandwich Bay Watershed Authority, an Atlantic Salmon assessment project was completed in 1999 on Paradise River, Labrador. The number of salmon entering Paradise River was estimated by mark recapture. Salmon were captured and marked in the estuary and then recaptured upstream at a tributary counting fence and in salmon traps set out in a pond in the main stem of the system. In total, about 800 salmon were caught at all sites. One hundred and fifty-six salmon were tagged and released from the lower site and, of these, 19 salmon were recaptured. The Petersen estimate of the number of salmon entering Paradise River was 5,172 salmon (95th C. I. 3,283 – 8,200) consisting of 4,681 small and 491 large salmon. Spawners and egg deposition were estimated using biological characteristics from salmon sampled in the estuary traps and compared to a habitat-weighted conservation requirement for Paradise River of 13.543 x 10^6 eggs. In 1999, 96% of this conservation requirement was met. In 1999, 331 small salmon and 43 large salmon were counted at the Southwest Brook counting fence compared to an adjusted count in 1998 of 110 small and 4 large salmon. Also 310 trout were counted in 1999 compared to 199 in 1998. This is the first successful assessment of a salmon stock in southern Labrador (SFA 2) since 1996. An assessment of risk indicated a high degree of variability in the results, which can only be improved through higher numbers of marked salmon, a more intensive sampling program and a biochemical technique to identify the sex of a salmon. In 1998 and 1999, seals were sited many times on the

river sometimes feeding on trout and salmon. It is recommended that detailed studies be conducted on predator-prey interactions at a population level in Paradise River.

Comments:

1. The conservation requirements for Labrador rivers have not been defined and the Eastern Canadian standard of 240 eggs per 100 m^2 may not be appropriate for northern rivers. The approximately 1 salmon per km^2 of drainage area seems very low when compared to some rivers in northern areas of the Island of Newfoundland. However, the percentage of conservation requirements achieved is 96% which is considerably higher than English River and Big Brook in northern Labrador.

2. The conservation requirements should be referred to as reference levels until more information becomes available from stock and recruit studies.

Recommendations:

1. Repeat mark-recapture in 2000 if funds are available.

The stock status of Atlantic salmon (*Salmo salar* L.) in Big Brook (Michaels River), Labrador in 1999

Authors: D. G. Reddin and P. B. Short

Summary: The status of the Atlantic salmon (*Salmo salar* L.) stock in Big Brook (also known as Michaels River), Labrador in 1999 was determined using counting fence data, samples collected in the angling fishery, and records of angling mortalities. The stock assessment was conducted in relation to the closure of the Atlantic salmon commercial fishery in Labrador in 1998. Also, this is the second assessment of a northern Labrador salmon stock. In 1999, total returns to Big Brook adjusted for a non-operational period of counting fence due to high water were 737 small and 180 large salmon. Small and large salmon made up 80.4 and 19.6%, respectively of returns to the river. The number of spawners adjusted for angling mortalities were 684 small and 166 large salmon. The egg deposition required for conservation for Big Brook is 5.294×10^3 eggs using information from a river survey conducted by Murphy (1973) and the salmon conservation requirement of 240 eggs per m^2. The egg requirement converts to 1,780 small and 439 large salmon. In 1999, the proportion achieved of the conservation egg requirements was 38% (95^{th} confidence intervals 27 to 51%). No trout or charr were observed at the counting fence.

Comments:

1. The conservation requirements for Labrador rivers have not been defined and the Eastern Canadian standard of 240 eggs per 100 m^2 may not be appropriate for northern rivers. The approximately 1 salmon per km^2 of drainage area seems very low when compared to some rivers in northern areas of the Island of Newfoundland. Also, the percentage of conservation requirements achieved is 38%, which is very low. The low performance may be simply due to its northern latitude compared to other rivers, climate change which may be impacting on northern rivers sooner and more severely than rivers to the south.

2. The conservation requirements should be referred to as reference levels until more information becomes available from stock and recruit studies.

3. Because the habitat survey did not include the ponds and some of the tributaries in the upper part of the watershed the habitat area for parr rearing is an under estimate.

Recommendations:

1. Repeat mark-recapture in 2000 if funds are available.

The stock status of Atlantic salmon (*Salmo salar* L.) in English River, Labrador in 1999

Authors: D. G. Reddin, P. B. Short, S. Lowe, and G. Sheppard

Summary: The status of the Atlantic salmon (*Salmo salar* L.) stock in English River, Labrador in 1999 was determined using counting fence data, samples collected in the angling fishery, and records of angling mortalities. The stock assessment was conducted in relation to a commercial salmon fishery buyout in Labrador in 1998 and restrictions to the angling fishery. This is the first assessment for the English River, Labrador salmon stock. In 1999, total returns to the English River counting fence were 59 small and 48 large salmon. The number of spawners adjusted for angling mortalities were 54 small and 46 large salmon. Also, 138 small and 160 large charr and 82 trout were counted at the fence. Since this is the first year for this project, there is a lack of information with which to derive conservation requirements.

Comments:

1. The conservation requirements for Labrador rivers have not been defined and the Eastern Canadian standard of 240 eggs per 100 m^2 may not be appropriate for northern rivers. The less than one half a salmon per km^2 of drainage area or 1.5

fish per km^2 of drainage area seems low when compared to some rivers in northern areas of the Island of Newfoundland. The low performance may be simply due to its northern latitude compared to other rivers, climate change which may be impacting on northern rivers sooner and more severely than rivers to the south.

2. The conservation requirements should be referred to as reference levels until more information becomes available from stock and recruit studies.

3. English River was not assessed in comparison to reference level of 240 eggs per 100 m^2 as habitat survey and biological characteristics data are required.

Recommendations:

1. Repeat in 2000 if funds are available.

2. Conduct habitat survey, more intensive netting, and electrofishing to determine why the apparent low population size.

Status of Atlantic Salmon (*Salmo salar* L.) in Gander River, Notre Dame Bay (SFA 4), Newfoundland, 1999

Authors: M. F. O'Connell, A. Walsh, and N. M. Cochrane

Summary: The status of Atlantic salmon in Gander River in 1999 was determined using counts of small and large salmon from a counting fence located on the main stem just above head of tide, recreational fishery data, and biological characteristics information. Total returns of small salmon in 1999 were similar in magnitude to 1998, maintaining a marked improvement over 1997, in which year the lowest returns of the commercial salmon fishery moratorium period occurred. Returns of large salmon in 1999 were the highest on record, as was the proportion of large salmon. Conservation egg requirement was exceeded in 1999 (121%). High water temperatures and low water levels were encountered early in 1999 compared to previous years, both at the counting fence and at the fishway in Salmon Brook tributary. The majority of returns to Salmon Brook occurred after the onset of increasing water levels in mid-August.

Status of Atlantic Salmon (*Salmo salar* L.) in Indian Bay Brook, Middle Brook, and Terra Nova River (SFA 5), Northeast Brook, Trepassey (SFA 9), and Northeast River, Placentia (SFA 10), Newfoundland, 1999

Authors: M. F. O'Connell, A. Walsh, and N. M. Cochrane

Summary: The status of Atlantic salmon stocks in 1999 was determined for Indian Bay Brook, Middle Brook, and Terra Nova River in Salmon Fishing Area (SFA 5),

Northeast Brook, Trepassey in SFA 9, and Northeast River, Placentia in SFA 10. Total returns of small salmon to Indian Bay Brook and Middle Brook in 1999 decreased from 1998 (17 and 23%) while Terra Nova River showed a slight increase (9%). Returns of small salmon to Northeast Brook, Trepassey were similar to 1998 while Northeast River, Placentia declined (59%) to the lowest level of the commercial salmon fishing moratorium period. Total returns of large salmon to Indian Bay Brook in 1999 increased by 9% over 1998, but decreases were noted for Middle Brook and Terra Nova River (34 and 12%). Northeast Brook, Trepassey showed an increase in large salmon returns in 1999 over 1988 (64%), but returns to Northeast River Placentia decreased (42%). Conservation egg requirement was achieved in all rivers except Terra Nova River. It should be noted that accessible rearing habitat above the lower Terra Nova River fishway more than doubled with the opening of the area above Mollyguajeck Falls in 1985. Smolt-to-adult survival for small salmon (repeat spawners included) for Northeast Brook, Trepassey in 1999 (adult year) was 5.5%, a slight improvement over the 5.0% observed in 1998, and low compared with the record high of 9.2% in 1996. The survival value for 1997 (2.9%) was the lowest of the moratorium years and the second lowest of the entire time series. Survival in terms of virgin grilse in 1999 was 5.0%. Egg-to-smolt survival for the 1994 spawning year-class was 0.40 (preliminary), a substantial decline from the high recorded for the 1992 year-class (1.09%), and more in line with values observed prior to 1992. Estimates of total river returns of small salmon to Indian Bay Brook in 1997-99, derived using angling data and the index river method, were three to four times higher than actual returns. Angling data were of some value with respect to indication of the overall direction of trends in abundance.

Status of Atlantic salmon (*Salmo salar* L.) in Campbellton River, Notre Dame Bay (SFA 4), Newfoundland in 1999

Authors: P. R. Downton, D. G. Reddin and R. W. Johnson

Summary: The status of Atlantic salmon in Campbellton River in 1999 was determined from the number of salmon counted through a portable fish counting weir (fence) located on the main stem just above head of the tide as well as from biological data collected from the recreational fishery. The assessment was conducted in response to major management changes that were introduced in 1992 and continued into 1999. Specifically, there was a moratorium on the commercial Atlantic salmon fishery in insular Newfoundland and restrictions were placed on recreational fishing in each Salmon Fishing Area. In 1999, adult returns were 3,076 small and 493 large salmon compared to the average of 3,061 small and 333 large salmon, 1993-98. Historical records indicate that circa. 1800, adult returns to a harvesting weir were about 12,000 salmon annually. The freshwater survival from eggs to smolt for the 1993 and 1994 year classes were 0.69% and 0.71%, respectively. The percent of the conservation egg requirement achieved for Campbellton River in 1999 was 326%. On average, for the period of 1993-99, Campbellton River achieved 281% of its conservation requirement.

Comments:

1. Smolt and adult counts were complete in 1999.

Recommendations:

1. Long-term funds should be found for Campbellton River project out of A-base DFO resources to ensure this very valuable project continues in the future.

Status of Atlantic salmon in Conne River, SFA 11, Newfoundland, 1999

Authors: J. B. Dempson, G. Furey, and M. Bloom

Summary: Conne River flows into Bay d'Espoir on the south coast of Newfoundland. Adult salmon escapements have been monitored with a fish counting fence since 1986 while smolt populations have been surveyed by mark-recapture since 1987. In 1999, returns to home waters (river and estuary) were 2358 salmon < 63 cm in length (small) and 241 salmon ≥ 63 cm (large) in size. This represented a decrease of 20% for small salmon compared with 1998 while large salmon returns declined by 18%. Marine survival of smolts to 1SW salmon increased somewhat over the previous year to 2.8%, but are still anomalously low. Estimated egg deposition from small and large salmon represented 68% of the current Management Target of 7.8 million eggs, but was 122% of the conservation egg requirement. Analysis of biological characteristic data indicated that the proportion of previous spawners in the small salmon category continues to remain high in recent years. The smolt run in 1999 was 9% less than the previous year, and has now fallen 37% since the peak run in 1997. Egg-to-smolt survival remains high, and was coincident with decreasing egg deposition per unit of fluvial habitat possibly suggestive of density-dependent processes. It was noted that egg-to-smolt survival will decrease substantially with the contribution from the 1995 spawning year class which had an egg deposition rate of approximately 480 eggs per 100 m^2 of fluvial habitat. This could again indicate that there may be little merit in maintaining a Management Target of 7.8 million eggs.

As specified in past years, the commercial salmon fishery moratorium has had a negligible impact on the Conne River salmon stock. Salmon returns and sea survival rates continue to remain below levels experienced during the pre-moratorium period (1986-1991).

Information on occurrences of escaped farmed rainbow (steelhead) trout in Conne River and records rainbow trout angled in the surrounding Bay d'Espoir area are also provided.

Comments:

1. Conne River is distinguished from other Newfoundland salmon rivers in having a defined management target for the required number of eggs or fish. This is different,

and higher, than a conservation requirement based on the habitat approach in place elsewhere in the Province. The management target was derived from fluvial habitat x 2.4 eggs/m^2 and egg/recruit applied to the 1987 total population size as determined from an assumed commercial exploitation rate and should be re-evaluated.

2. It was noted that estimates of egg-to-smolt survival have increased coincident with declining egg depositions per unit area of fluvial habitat. The increased freshwater survival and highest smolt production on record is consistent with a number of other salmon stocks that have experienced increased freshwater survival in recent years.

Status of the Exploits River stock of Atlantic salmon (*Salmo salar* L.) in 1999

Authors: C. E. Bourgeois, J. Murray, and V. Mercer

Summary: The status of Atlantic salmon in the Exploits River in 1999 was derived from three fishway counts, recreational fishery data, fecundity data and biological characteristic data for the Exploits stock. The 1999 run timing was the second earliest on record and resulted in the second highest escapement to the watershed. River escapement of 31,038, composed of 28,802 small and 2,236 large, salmon is second only to the 1998 river escapement. The watershed received 49% of the required conservation egg deposition with the lower, middle and upper sections of the watershed receiving 146%, 35% and 7% respectively. Since 1996 the portion of the river escapement migrating upstream of Grand Falls has been increasing suggesting previous enhancement efforts are proving worthwhile. The 1999 recreational catch was 3,234 salmon (1,951 retained and 1,283 released).

Comments:

1. Concern was expressed over the low level of returns to the upper section (area upstream of Red Indian Lake) of the watershed.

Recommendations:

1. Increase the management target on the Exploits River from 13,000 to 18,000 spawners.

2. Conduct an angling creel on the area below Bishop Falls similar to that conducted in 1999.

3. Close the recreational fishery on July 5 from Red Indian Lake dam to the steel bridge just downstream.

Status of Rocky and Little rivers Atlantic salmon (*Salmo salar* L.) stocks of the Newfoundland Region in 1999

Authors: C. E. Bourgeois, J. Murray, and V. Mercer

Summary: Stock assessments were conducted for two enhanced rivers namely Rocky (SFA 9) and Little River (SFA 11). Stock status was determined for Rocky River and Little River through complete counts of large and small salmon at a fishway and a counting fence respectively. Fry stocking was conducted on Little River in the spring of 1999. Rocky and Little rivers received 39% and 38% of their respective conservation egg depositions. Rocky and Little rivers are closed to recreational fishing. Smolt-to-1SW survival for Rocky River decreased to 1.79% for the 1998 smolt class.

The status of the Atlantic salmon stock of the Northwest River, Bonavista Bay (SFA 5), Newfoundland, 1999

Authors: M. Simpson

Summary: The status of the Atlantic salmon was determined for Northwest River which is located in Salmon Fishing Area (SFA) 5. In 1999, total returns to the river were 314 small and 93 large salmon. The proportion of the conservation egg requirement achieved was 28%. Northwest River has been closed to all angling since 1996.

Status of Atlantic salmon at Highlands River, Bay St. George, SFA 13, Newfoundland, 1999

Authors: J. B. Dempson, G. Clarke

Summary: Highlands River flows into Bay St. George on the southwest coast of Newfoundland. Adult salmon escapements have been monitored with a fish counting fence from 1980-1982 and again from 1993 to 1999. In 1999, returns were 146 salmon < 63 cm in length (small) and 82 salmon ≥ 63 cm (large) in size. This represented an increase of 52% for small salmon compared with 1998 but a 30% decline in numbers of large salmon from the previous year. Marine survival increased on both small and large salmon size components, but is still anomalously low given the substantial reductions in directed marine fisheries for Atlantic salmon. Estimated egg deposition from small and large salmon represented 48.8% (39.1 – 58.9%) of the conservation requirement. Analysis of biological characteristic data indicated that small salmon were predominantly one-sea-winter fish (96.5%) whereas 61% of large salmon were maiden 2SW salmon, 29.9% previous spawners and 3.6% were virgin 3SW fish. The smolt run in 1999 increased by 63% over 1998, but was still somewhat low by comparison with earlier years. Conservation requirements are not expected to be met in 2000 unless marine survival rates for large salmon exceed values achieved in the past.

As stated last year, density independent factors may be more important in regulating salmon production levels than density dependent processes. Given the history of extreme high water events at Highlands River, which may act to periodically 'flush' the system of many juvenile salmon, it is doubtful that runs of adult salmon to Highlands River will be sustainable around the current conservation spawning requirement.

Recommendations:

1. Scale samples of smolts collected in 1999 should be re-examined as ages appear to be inconsistent with other years.

Predation on Atlantic salmon smolts (*Salmo salar* L.) by avian and gadoid predators in Campbellton River estuary, Newfoundland, 1998-99

Authors: P. Downton, D. G. Reddin and R. Johnson

Summary: Observations of marine predation on salmon smolts were made during the spring of 1998 and 1999 near the vicinity and in the estuary of Campbellton River. Birds and cod were observed preying and feeding on salmon smolts. Seals were observed within the study area during both years of the study and in 1998 a harp seal was captured during gill netting for cod. Out of 377 Atlantic cod stomachs examined in 1998-99, 3 or 0.8% contained salmon smolts. Out of 50 rock cod stomachs examined in 1998-99, 6 or about 12% contained salmon smolts. Avian predators included herring gulls, black-backed gulls, terns and gannets. All four species were observed feeding on smolts in shallow water at the river mouth. Also, herring gulls were observed feeding on smolts in the vicinity of the counting fence. While the feeding rate by Atlantic cod was low, the higher feeding rates by rock cod and avian predators suggests that the accumulative effects of predation in the estuary could be important to survival of adult salmon back to Campbellton River. More research would be required to quantify the effects of predation on the salmon population.

Comments:

1. Possibility of examining diets from nesting birds based on casts/regurgitation should be pursued.

2. While overall predation on salmon smolts does not appear to be an important diet item for either cod or birds it may still be significantly reducing the number of salmon smolts and adult returns to Campbellton River.

Recommendations:

1. The predation study should be repeated in 2000.

2. If possible, cod predation experimentation would be greatly enhanced by a mark-recapture experiment to estimate the number of cod in the area.

Predation on Atlantic salmon by northern gannets in the northwest Atlantic

Authors: W. A. Montevecchi, D. K. Cairns, and R. A. Myers

Summary: We use a 22 year time-series of prey landed by northern gannets (*Morus bassanus*) in a large breeding colony on Funk Island off the northeast coast of Newfoundland in NAFO area 3L to: 1) derive information on the biology of post-smolt Atlantic salmon (*Salmo salar*) and 2) evaluate potential influences of predation by gannets on salmon populations. Post-smolts measured at Funk Island on a mean date of 9 August had a mean (± SD) fork length of 23.4 ± 1.9 cm. During August 1977-1989, post-smolts occurred sporadically in the prey that gannets fed to their chicks and contributed a mean of 0.29% of estimated food consumed. Post-smolt representation (in August) rose sharply in the 1990s, peaking at 6.37% of food consumed in 1993, and with a mean for the decade of 2.78%. The increase of salmon in gannets' diets coincided with large-scale changes in demersal and pelagic fish communities in the Labrador Sea. Water temperature in the area dropped precipitously in 1991, though this decrease occurred one year after the salmon contribution to the gannets' diet began to increase. A bioenergetics model estimated that gannets consumed a mean of 1.6 and 19.8 t of post-smolt salmon in August 1977-`989 and August 1990-1999, respectively. Model runs using stochastically varied inputs demonstrate that these harvest estimates have a broad margin of error. Estimated post-smolt consumption by gannets on Funk Island was 0.22 and 2.96% of estimated North American post-smolt biomass in August 1977-1989 and 1990-1999, respectively. All North American gannetries are situated in the migratory pathways of post-smolts and their summed populations increased by 143% between 1977 and 1999. Long-term data on gannet diets are available only for Funk Island in August. If post-smolt contribution to diets of gannets at other colonies and during other months has been similar to their contribution at Funk Island in August in the 1990s, then gannets consumption of post-smolts would amount to a substantial fraction of estimated North American post-smolt biomass.

Further evaluation of juvenile Atlantic salmon (*Salmo salar* L.) abundance in the Experimental Ponds Area relative to subsequent adult returns to Gander River and the empirical evidence for density-dependent marine mortality

Authors: R. Knoechel, P. M. Ryan, and M. F. O'Connell

Summary: A marine survival ratio index was calculated as the number of adult salmon returning to the Gander River divided by the total juvenile salmon populations in the Experimental Ponds Area (EPA) at the headwaters of the river in the previous spring. This survival index increased more than four-fold in the first four years (1992-95) following closure of the commercial fishery in 1992 but then dropped moderately in 1996 and then precipitously in 1997, in concert with rapidly increasing juvenile abundance, a pattern consistent with an interpretation of density-dependent mortality. Juvenile abundance was low in 1998 leading to a prediction of an increase in the marine survival index in 1999; this prediction is confirmed in the present study. We herein extend the relationship between the marine survival index and EPA juvenile abundance further back in time by using long-term records of adult returns to the Salmon Brook fishway as an index of whole river returns. This analysis indicates that the apparent negative density dependence is consistent over a span of slightly more than two decades. The EPA juvenile abundance increased from very low levels in 1998 to near record levels in 1999. If the density-dependent model is correct, marine survival this year should be low and year 2000 returns of small adult salmon to the Gander River should be only 13,782 which is far below the conservation requirement of 21,828. In contrast, small adult salmon returns are predicted to increase to a record level of 49,073 if the high survival index calculated for 1999 is applied to year 2000 returns. Continued monitoring of the adult returns in 2000 should provide a strong test of the apparent historic relationship.

Status of the Atlantic salmon (*Salmo salar* L.) stock of Harry's River/Pinchgut Brook, Newfoundland, 1999

Authors: C. C. Mullins and D. Caines

Summary: The number and the proportion of small salmon at the counting fence on the Pinchgut Brook tributary of Harry's River increased in 1999 but were within 10% of those in 1998. The number of large salmon remained the same as in 1998. The conservation egg deposition requirement was not achieved on the Harry's River in 1999. The Harry's River salmon stock has achieved at most only 52% of the requirement in the last eight years. This is alarming considering the recreational salmon fishery has been restricted to catch and release angling since 1996 and the commercial salmon fishery has been closed since 1992. Uncertainties associated with the estimation of spawning escapement and egg deposition on Harry's River as a whole based on counts at Pinchgut Brook tributary were analysed using a probability density

function. The results indicated that there was a greater than 100% probability that the conservation requirement was not achieved on the Harry's River in 1999. Increased juvenile densities in recent years indicate a positive outlook for this stock. However, poor environmental conditions in freshwater and continuing evidence of illegal removals continue to cause concern.

Comments:

1. There is a great deal of concern about the status of the Harry's River salmon stock. The river once produced the highest recreational fishery catches of all rivers in the Bay St. George area of SFA 13. The current technique of using the spawning on Pinchgut Brook to estimate the total spawning escapement on Harry's River is a reasonable and inexpensive method of assessing the status of this stock. Based on three spawning surveys conducted in 1995-97, there appears to be little variation in the distribution of spawning within the on Harry's River system. However, the low water levels experienced in 1999 could cause some redistribution of spawning salmon. At this point, the spawning survey needs to be completed every year to account for possible redistribution and to identify all possible spawning areas.

2. Previous attempts at using a counting fence to assess the entire run to Harry's River were largely unsuccessful due to extreme fluctuations in water level. However, new counting fence techniques combined with the low water levels experienced in recent years suggest that such an initiative would now have a greater chance of success.

Recommendations:

1. It is recommended that the recreational fishery on this stock continue to be managed in such a way that the spawning stock is maximised.

2. Salmon returns to the Pinchgut Brook tributary relative to Harry's River, as a whole, can only be fully understood through knowledge of the total number of salmon entering the system. This could be achieved by installing a counting fence near the mouth of the river supplemented by mark-recapture tagging. The tagging would provide a means of verifying the proportion of salmon spawning on Pinchgut Brook, thus eliminating some of the uncertainty.

3. Biological characteristics information for small and large salmon needs to be updated for Harry's River based on internal sex determination.

Status of the Atlantic salmon (*Salmo salar* L.) stock of Humber River, Newfoundland, 1999

Authors: C. C. Mullins and D. Caines

Summary: This is the tenth assessment of the Atlantic salmon stock of the Humber River. The results of the mark-recapture study in 1999 indicated that 27,585 (95% CI= 20,779 - 37,984) small and 4,433 (95% CI= 3,042 - 6,675) large salmon returned to the Humber River during the period of the study. The recapture trap used in 1999 was preferable to angling for tag recaptures because no adjustment is necessary to account for the voluntary tag-reporting rate and the catch did not have to be estimated. A double-tagging experiment indicated no tag loss for salmon recaptured in the recapture trap and by angling. This suggested that calculation methods used in previous years might have resulted in an under-estimate of tag retention rate and possibly, then, a small under-estimate of population size. The recreational fishery retained catch of small salmon was higher than in 1998 but the released catch was lower. The released catch of large salmon was higher than in 1998. Increased retention limits and removal of split season restrictions as well as increased returns may have contributed to improved angling catches. The proportion of large salmon caught in the estuary tagging traps was lower than in 1998 but equal to 1992-98 mean. Egg depositions calculated for 1999 were 201% (95% CI = 144% - 290%) of the conservation requirement. This level of egg deposition had a very high probability of occurrence based a probability density function used to account for some of the uncertainty associated with the returns estimate and biological parameters. Potential sources of mortality that could result in additional uncertainty in the status of the stock included record low water levels, increased indications of illegal removals and reports of seals on the river. Recruits in 1999 exceeded estimates of the spawners that produced them indicating continued improvement in the stock. However, the fluctuation in returns experienced in recent years continues to create a level of uncertainty.

Comments:

1. The Humber River salmon stock, while below the conservation requirement in some years, is showing signs of improvement. However, the growth of the spawning population has been minimal in some recent years (ex. 1997-98). If the survival rate of year-classes contributing to returns in 2000 is as low as for those contributing to returns in 1997-98, then low population growth could be experienced again in 2000. Because of the potential for over-exploiting the stock if returns are low, exploitation should be closely monitored.

2. The fall run of salmon to the Lower Humber River appears to contain all age groups including previous spawners. Thus, the actual population of three-sea-winter salmon may be very low. The mark-recapture project is essential for assessing the Humber River salmon population.

3. Returns to the river in 1998 were revised based on updated angling catch data and indicated that the conservation requirement was exceeded in 1998.

Recommendations:

1. To continue to improve the mark-recapture on the Humber River, it is recommended that tag recovery techniques continue to be developed that are independent of the recreational fishery. This would eliminate uncertainty associated with estimation of the angling catch and voluntary tag reporting by anglers. It is also recommended that tag loss be estimated annually by double-tagging.

Status of Atlantic Salmon (*Salmo salar* L.) populations in Crabbes and Robinsons Rivers, and Middle Barachois, Fischells and Flat Bay Brooks, Newfoundland, 1999

Authors: T. R. Porter.

Summary: Adult Atlantic salmon were visually counted in Crabbes River, Middle Barachois Brook, Robinsons River, Fischells Brook, and Flat Bay Brook, 23-29 August 1999. Surveys were conducted by crews of 3 to 12 snorkellers floating down the main stem of each river. Water levels were moderately low and salmon were predominately concentrated in pools with water depths < 1m. An adjustment factor, ranging from 1.0 to 1.5, was applied to the counts in each river section to account for fish not observed in the larger pools. Since there were no known removals after the survey, the adjusted count is considered to be the spawning escapement for the river. There were no retention angling fisheries on these rivers in 1999, but an assumed mortality of 10% was applied to the estimates of the numbers of salmon that were hooked-and-released. The estimated total numbers of salmon that returned to each river are: Crabbes River, 686 small and 264 large salmon; Middle Barachois Brook, 559 small and 67 large; Robinsons River, 1431 small and 203 large; Fischells Brook, 1264 small and 246 large; and, Flat Bay Brook, 2261 small and 235 large salmon. The percentage of the conservation egg requirements achieved were 65% for Crabbes River, 44% - Middle Barachois Brook, 117% - Robinsons River, 110% - Fischells Brook, and 149% for Flat Bay Brook. Egg deposition is higher in 1999 than in 1998 for all rivers except Middle Barachois Brook. The apparent low egg deposition in Crabbes River and Middle Barachois Brook may be related to the unusually severe flood that occurred in February 1996, which may have caused high juvenile mortalities. The information available did not lend itself to forecasting the abundance of salmon in 2000. Two rainbow trout were observed in Robinsons River and Flat Bay Brook. Their origin is unknown.

Comments:

1. Biological characteristics information should be included in Research Document.

2. It would be desirable to investigate the impact of the 1996 flood had on the population of Middle Barachois.

3. There is no exclusion zone for angling on Flat Bay Brook.

Recommendations:

1. Next year risk analysis (vary certain parameters) should be built into the assessment.

2. Biological characteristics data should be collected for Crabbes, Robinsons, Fischells and Flat Bay brooks.

Status report for northern Labrador Arctic charr, 1999

Authors: J. B. Dempson and M. Shears

Summary: Northern Labrador Arctic charr landings in 1999 totalled 40.5 t, an increase of about 8% over the previous year and were the highest recorded since 1992. Increased effort in the Napartok Bay and Tasiuyak subareas, which are outside of the three primary stock complexes (Voisey, Nain and Okak), contributed 35% of the production in 1999. Effort in recent years is still low relative to the 1980's, and interpretation of current commercial catch rates as an index of stock abundance could be problematic. Landings of Arctic charr from the Nain Fishing Region over the past 25 years (1974 - 1999) totalled approximately 2629 tonnes, or almost 5.8 million pounds. Of this amount, 77% has been harvested from the three primary stock complexes (Voisey, Nain, Okak) and illustrates the overall capacity of this north coast area to produce fish.

Information on catch- and weight-at-age for each of the Voisey, Nain, and Okak stock units were updated. Mean weight of charr harvested increased again in each of the three stock units in 1999; for the Voisey's and Nain units, it was the highest mean weight since 1991, and the highest recorded for Okak since 1990. Tag release and recapture information was updated with data current as of 1999.

It was again noted that there are no independent estimates of Arctic charr abundance for any of the stock unit areas. In the absence of river-specific information on charr abundance and monitoring of stock characteristics, only general statements can be made regarding the status of north Labrador charr populations. Concern over the status of the Arctic charr resource at Nain Bay (Fraser River), Anaktalik Bay, and Okak Bay has been raised by local fishers.

Recommendations:

1. Fish counting facilities are required in order to obtain actual information on Arctic charr abundance. Given the increased commercial harvests in recent years, and the expansion of food fishing activities, at least one counting facility should be installed in a brook in each of the three primary stock complex areas (Voisey, Nain, Okak).

Status of Atlantic salmon (*Salmo salar* L.) stocks of Lomond River, Torrent River and Western Arm Brook, Newfoundland, 1999

Author: C. C. Mullins, D. Caines

Summary: Returns of small salmon to Lomond River were 42% higher than in 1998 and 8% higher than the 1992-98 mean. Returns of large salmon were the third highest on record and 46% higher than the 1992-93 mean. Returns of small salmon to Torrent River were 19% less than in 1998 and 10% lower than the 1992-98 mean. Returns of large salmon in 1999 were 46% less than in 1998 and 13% less than the 1992-98 mean. Returns of small salmon to Western Arm Brook were 39% less than in 1998 but 10% higher than the 1992-98 mean. Returns of large salmon were 82% less than in 1998 and 50% less than the 1992-98 mean. Returns of both small and large salmon to all three rivers were higher than the 1984-91 means indicating improvements in the stocks since the commercial salmon fishery moratorium. The proportion of large salmon was higher than the 1984-91 mean on all three rivers. It is highly unlikely that the conservation requirement was not achieved on any of the three rivers in 1999. Based on the smolt production at Western Arm Brook in 1999 returns of 1SW salmon in 2000 are expected to be lower than in 1999 and the 1992-98 mean provided marine survival remains the same. Marine survival of smolts to returning 1SW salmon at Western Arm Brook was 6.1% in 1999, more than twice that in 1997. Spawning escapements are expected to exceed conservation requirements on all three rivers in 2000 assuming marine survival remains the same as in 1999. A decline in marine survival similar to that, which occurred in 1997, would mean that conservation requirements would likely not be achieved on Western Arm Brook in 2000.

Comments:

1. Owing to overall improvements in these stocks and the added control afforded by the river classification system, there may be opportunities on these rivers for increased harvests below counting facilities. However, given the uncertainty in annual marine survival observed for Western Arm Brook it is cautioned that harvests on this river in particular should not be permitted until the conservation requirement (300 salmon) has been achieved.

2. There has been a significant increase in the total population size of small salmon on Torrent River. This is attributed to the enhancement program carried out in the early 1970s that involved transfers of adult salmon from Western Arm Brook.

Recommendations:

1. Expansion of fisheries above counting facilities on all three selected rivers is not recommended unless angling catches can be an accurately determined in order to maintain scientific integrity of long time series of adult return and spawning escapement data.

2. Available harvest for Western Arm Brook should be determined based on the spawner-recruit curve.

3. Habitat estimates for Torrent River should be verified from digitised 1:50,000 scale topographic maps and from in-stream measurements. In comparison to the available habitat on Lomond River, the available habitat on Torrent River seems quite small given the larger drainage basin area.

4. The conservation requirement of 105 eggs per ha of lacustrine habitat used for Torrent River and Western Arm Brook should be re-examined.

Observations of Rainbow Trout (*Oncorhynchus mykiss)* in Newfoundland 1976 to 1999

Authors: T. R. Porter

- Rainbow trout are not native to Newfoundland. Populations were established through stocking programs in the late 1800s and early 1900s in several small watersheds on the Northeast Avalon Peninsula, several small streams in the Clarenville area, Shalloway Pond Brook (Placentia Bay) and a watershed at Tilt Cove, Baie Verte Peninsula (Table 1). These populations are freshwater resident populations, other than the populations near Clarenville and Shalloway Pond Brook, which are known to have an anadromous component.

- A small aquaculture operation for rainbow trout was established at Hopeall, Trinity Bay, in the mid-1970's. The initial broodstock was resident wild populations from the Northeast Avalon Peninsula. Anglers captured rainbow trout that had escaped from cage rearing operations in the late 1970's and 1980's. Few rainbow trout are being angled in recent years.

- There are no known reports of rainbow trout being observed outside these areas before 1979.

- From 1979 to 1995, small numbers of rainbow trout have been reported captured on the West Coast of NF (Table 2).

- On the south coast triploid rainbow trout have been observed in rivers in Bay d'Espoir since 1990 shortly after marine cage rearing of triploid rainbow trout began in the late 1980s. The first reported occurrence of rainbow trout on the South Coast outside Bay d'Espoir occurred in 1998 (Table 2).

- The distribution of rainbow trout in rivers along the South and West coasts of Newfoundland that contain Atlantic salmon populations appear to be more extensive in 1999 than in previous years.

- There were observations or reports of rainbow trout in 6 rivers on the West Coast of Newfoundland in 1999 (Table 2).

- On the South coast, rainbow trout were angled in 5 rivers as well as captured in a commercial fishermen's bait net (Table 2)

- Only one specimen (Trout River) was biologically sampled, in 1999. It was 25 cm in length and sexed as an immature female.

- There is no definitive evidence to confirm the origin of the rainbow trout observed. The circumstantial evidence would suggest that some, if not all, of those fish on the West Coast of Newfoundland are of Maritime origin. The evidence is as follows: 1) there are no known populations established on the West Coast; 2) some occurrences were before the development of the aquaculture industry in Bay d'Espoir; 3) some of the specimens that were sampled were identified as diploid male rainbow trout; 4) marine cage in Bay d'Espoir have used all-female triploid rainbow trout.

- There is concern that straying of reproductively viable diploid rainbow of both sexes from the Maritimes could result in the successful establishment of rainbow trout in Newfoundland, particularly on the West Coast where environmental conditions are most conducive to successful reproduction. The risk of such an occurrence would increase with the marine cage rearing of all-female diploid rainbow trout in Newfoundland. Colonisation of rainbow trout could have a serious negative impact on the productivity of indigenous Atlantic salmon and brook trout populations.

Table 1. Areas where rainbow trout are known to have established populations.

Year	Location	Comments
Late 1800's	Several small steams and ponds NE Avalon	Population established from stocking in late 1800's and early 1900's.
Early 1900's	Shoal Harbour Bk, Georges Bk, lower Shoal Harbour Bk, Adeytown Bk.	Population established from stocking in early 1900's. Samples collected in 1974. One male trout found dead in lower Shoal Harbour River July 6, 1984
Early 1900's	One watershed at Tilt Cove	Population established from stocking. Date unknown. Samples collected in 1987
Early 1900's	Shalloway Pond Brook	Population established from stocking. Date unknown

Table 2. Observed and reported occurrences of rainbow trout outside river systems where there are established populations.

Year	Location	Sex	Number	Comments
1976–85	Steams near Hopeall			Angled during late 1970's and early 1980's. Assumed to be escapes from aquaculture
1979	Watt's Bight Brook	M (1) (external)	3	Angled (late May)
1980	Ocean - Daniels Harbour	M (internal)	1	Caught in commercial salmon net July 2 1980
1980	Serpentine River		2	Angled in early July
1981	Trout River	F (1) (external)	4	Angled in early September. One fish sampled. definitely hatchery origin
1985-95	River of Ponds			Fisheries Officer reports rainbow trout have been angled in Aug in lower part of river1985-95, average weight 1.5-2 lbs
1990	Conne River		3	1 – downstream trap; 1 – upstream trap 1- found dead on beach
1991	Conne River		47	18 angled; 3 – upstream trap; 5 – downstream trap; 21 observed in river. There maybe some double counting.
1992	Conne River		3	2 in downstream and 1 in upstream trap
1993	Conne River		11	8 in downstream and 3 in upstream trap.
1994	Conne River		13	6 in downstream and 5 in upstream trap; 2 captured electrofishing
1995	Conne River		39	5 in downstream and 16 in upstream trap; 16 underwater observations; 2 dead on fence. There maybe some double counting.
1995	River of Ponds	M (1)	3	Angled in August. Only one sampled
1995	Parsons Pond			Angled
1995	Flat Bay Brook	M (1)	1	Caught in upstream trap. 38.7 cm
1996	Conne River		41	2 in downstream and 16 in upstream trap; 22 observed underwater; 1- mortality at fence. There maybe some double counting.
1996	Little River		5	5 in upstream trap
1997	Conne River		61	5 in downstream and 3 in upstream trap; 51 observed underwater; 2- mortality at fence. There maybe some double counting.
1998	Conne River		27	1 in downstream and 3 in upstream trap; 21 observed underwater; 2- mortality at fence. There maybe some double counting.
1998	Long Harbour River		1+	Angled in lower river.
1998	Grand Bank Bk		1+	Several angled in estuary
1998	Biscay Bay Bk		2	Angled in lower river.
1999	River of Ponds		24	Angled
1999	Portland Creek		1	Angled
1999	Trout River	F (1)	1+	Several angled in August
1999	Humber River		3	Angled
1999	Flat Bay Brook		2	Observed during spawner survey
1999	Robinsons River		2	Observed during spawner survey
1999	Marine, near Burnt Is.		6 or 7	Caught in commercial bait net

Table 2 con't. Observed and reported occurrences of rainbow trout outside river systems where there are established populations.

Year	Location	Sex	Number	Comments
1999	La Poile River		3	Angled
1999	Garia Brook		3	Angled
1999	Conne River		3 18	Upstream trap Angled April 23- Aug 12
1999	Marine Bay d'Espoir and streams flowing into Bay d'Espoir		3,650	Angled trout reported by Guardians
1999	Little River		1	Upstream trap

Status of Atlantic Salmon (*Salmo salar* L.) Stocks of Insular Newfoundland (SFAs 3-14A), 1999

Authors: M. F. O'Connell, J. B. Dempson, C. C. Mullins, D. G. Reddin, N. M. Cochrane, and D. Caines

Summary: The commercial Atlantic salmon fishery moratorium implemented in insular Newfoundland in 1992 entered its eighth year in 1999. On the northeast and east coasts of insular Newfoundland (SFAs 4 and 5), total returns of small salmon in 1999 increased slightly over or were similar to those of 1998 in four out of seven monitored rivers; one river showed an increase over the 1992-98 mean, three were similar, and two decreased. On the south coast (SFAs 9-11), total returns of small salmon increased over or were similar to those of 1998 in two rivers and decreased in three; two rivers increased, one remained the same, and two decreased in relation to the 1992-98 mean. Total returns of small salmon to rivers in SFA 13 (including those in Bay St. George) in 1999 showed a marked improvement over recent years. Total returns of small salmon decreased from 1998 in two out of three monitored rivers in SFA 14A; two rivers showed increases over the 1992-98 means while the other had a slight decrease. Returns of large salmon and proportions of large salmon in total returns to most rivers in 1999 exceeded or were similar to the means for 1992-98 and several rivers had the highest or among the highest levels on record. Smolt-to-adult survival remained low overall in 1999. Smolt production decreased from that of 1998 at all counting facilities (ranging from 5 to 29%) except one, which increased by 60%. Unless there is an improvement in marine survival rates, it is expected that numbers of small salmon returning to insular Newfoundland rivers in year 2000, in general, will be lower than in 1999.

Appendix 1

Newfoundland Region Preliminary Salmonid Stock Assessment Meeting

Northwest Atlantic Fisheries Centre, St. John's, NF

Date: November, 3, 1999
Location: EPS Boardroom
Time: 0900 – 1630 hrs

AGENDA

1 - General review of salmon stock status
  Newfoundland - O'Connell
  Labrador - Reddin

2 - Summary of marine survival & smolt production: prognosis for Y2K- Dempson

3 - Preliminary results from Bay St. George river snorkel surveys - Porter

4 - Review of river classifications - O'Connell
  - Fischells, Robinsons, Flat Bay brooks – potential for limited fisheries?

5 - Review of season opening dates for salmon retention – SFAs 9 – 12

6 - Review and discussion of environmental protocols:
  - temperature protocols for Class 1 rivers & catch-and-release
  - flow/discharge protocols

7 - Mark-recapture surveys:
  - Humber River – Mullins
  - Paradise River – Reddin

8 - Provision for retention of large salmon beginning in 2002?

9 - Exploits River - Bourgeois
  - review of current management target
  - change in river classification – main stem to Harpoon Brook
  - other

10 - Advice to fisheries management

11 - Topics for discussion at winter assessment meeting

Appendix 2

Newfoundland Region Salmonid Stock Assessment Meeting

Northwest Atlantic Fisheries Centre, St. John's, NF

Date: March 6 - 9, 2000
Location: Belle Bay Boardroom
Time: 0900 – 1630 hrs

AGENDA

1 - Call to order

2 - Finalization of agenda

3 - Review of Newfoundland Region stock assessment documentation process with emphasis on the Stock Status Report

4 - Marine and freshwater environments in 1999

4.1 Climate change and salmon at sea

5 - Atlantic salmon licence stub returns for 1999 and revisions to past years

6 - Atlantic salmon river-specific stock assessments

6.1 Labrador (SFAs 1 – 2, 14B)

6.11 Paradise River
6.12 Big Brook (Michael's River)
6.13 English River

6.2 Northeast and east coast Newfoundland (SFAs 3 – 8)

6.21 Exploits River
6.22 Gander River
6.23 Gander River – juvenile salmonid production
6.24 Campbellton River
6.25 Middle Brook
6.26 Indian Bay Brook
6.27 Terra Nova River
6.28 Northwest River, Terra Nova National Park

6.2 South coast Newfoundland (SFAs 9 – 11)

6.21 Rocky River
6.22 Northeast Brook, Trepassey
6.23 Northeast River, Placentia
6.24 Little River
6.25 Conne River

6.3 Southwest Newfoundland (SFAs 12 – 13)

6.31 Highlands River
6.32 Crabbes, Middle Barachois, Robinsons, Fischells, Flat Bay
6.33 Harry's / Pinchgut
6.34 Humber River

6.3 Northern Peninsula west (SFA 14A)

6.41 Lomond River
6.42 Torrent River
6.43 Western Arm Brook

7 - Arctic charr

7.1 Review of Voisey, Nain and Okak stock complexes

8 - Other salmonid issues

8.1 Conservation spawning requirements vs Management Targets
8.2 Campbellton River predation study
8.3 Results of 1999 'Kiwi' tagging study: Highlands and Campbellton rivers
8.4 Seal – Salmon interactions - Sandwich Bay, Labrador
8.5 Use of "Indicator Rivers"
8.6 Methodology to address issue of allowing a retention fishery on large salmon
8.7 Incorporation of uncertainty and risk in salmon assessments

9 - Other business

Appendix 3

List of Participants

Name	Organization	Meeting	
		November 1999	March 2000
Bourgeois, C.	DFO Science, Nfld	X	X
Colbourne, E.	DFO Science, Nfld		
X			
Curnew, K.	DFRA Inland Fish & Wildlife		X
Dempson, B (Chair)	DFO Science, Nfld	X	X
Knoechel, R.	Memorial University, Nfld		X
Montevecchi B.	Memorial University, Nfld		X
Mullins, C.	DFO Science, Nfld	X	X
O'Connell, M.	DFO Science, Nfld	X	X
Perry, G.	DFO Fish. Management, Nfld		X
Porter, R.	DFO Science, Nfld		X
Reddin, D.	DFO Science, Nfld	X	X
Simpson, M.	Parks Canada (Terra Nova)		X
Sjare, B.	DFO Science, Nfld		
X			
Slade, B.	DFO Fish. Management, Nfld		X

Appendix 4

List of Working papers

1. Colbourne, E. 2000. Oceanographic Conditions in NAFO Subdivisions 3Pn and 3Ps during 1999 with comparisons to the long-term (1961-1990) average.

2. Colbourne, E. 2000. Oceanographic Conditions in NAFO Subdivisions 2J 3KLMNO during 1999 with comparisons to the long-term (1961-1990) average.

3. Reddin, D. G. 2000. Comparison of small and large salmon (*Salmo salar* L.)in angling catch data for Labrador.

4. Reddin, D. G., P. B. Short, R. Johnson and J. Bird. 2000. The stock status of Atlantic salmon (*Salmo salar* L.) in Paradise River, Labrador in 1999.

5. Reddin, D. G. and P. B. Short. 2000. The stock status of Atlantic salmon (*Salmo salar* L.) in Big Brook (Michaels River), Labrador, 1999.

6. Reddin, D. G., P. B. Short, G. Sheppard and S. Lowe. 2000. The stock status of Atlantic salmon (*Salmo salar* L.) in English River, Labrador, 1999.

7. O'Connell, M. F., A. Walsh and N. M. Cochrane. 2000. Status of Atlantic salmon (*Salmo salar* L.)in Gander River, Notre Dame Bay (SFA 4), Newfoundland, 1999.

8. O'Connell, M.F., A. Walsh and N. M. Cochrane. 2000. Status of Atlantic salmon (*Salmo salar* L.) In Indian bay Brook, Middle Brook, and Terra Nova River (SFA 5), Northeast Brook, Trepassey (SFA 9), and Northeast River, Placentia (SFA 10), Newfoundland, in 1999.

9. Downton, P. R., D. G. Reddin and R. Johnson. 2000. Status of Atlantic salmon (*Salmo salar* L.) in Campbellton River, Notre Dame Bay (SFA 4), Newfoundland in 1999.

10. Dempson, J. B.,G. Furey and M. Bloom. 2000. Status of Atlantic salmon in Conne River, SFA 11, Newfoundland, 1999.

11. Bourgeois, C. E., J. Murray and V. Mercer. 2000. Status of the Exploits River stock of Atlantic salmon (*Salmo salar*) in 1999.

12. Bourgeois, C. E. J. Murray and V. Mercer. 2000. Status of Rocky and Little rivers Atlantic salmon (*Salmo salar* L.) stocks of the Newfoundland Region in 1999.

13. Simpson, M. 2000. The status of the Atlantic Salmon Stock of the Northwest River, Bonavista Bay (SFA 5), Newfoundland. 1999.

14. Dempson, J. B. and G. Clarke. 2000. Status of Atlantic salmon at Highlands River, Bay St. George, SFA 13, Newfoundland, 1999.

15. Downton, P., D. G. Reddin, and R. Johnson. 2000. Predation of Atlantic salmon smolts (*Salmo salar* L.) by avian and gadoid predators in Campbellton River estuary, Newfoundland, 1998-89.

16. Montevecchi, W. A., D. K. Cairns and R. A. Myers. 2000. Predation on Atlantic salmon by northern gannets in the northwest Atlantic.

17. Knoechel, R., P. M. Ryan and M. F. O'Connell.2000. Further evaluation of juvenile Atlantic salmon (*Salmo salar* L.) abundance in the Experimental Ponds Area relative to subsequent adult returns to Gander River and the empirical evidence for density-dependant marine mortality.

18. Mullins, C. C. and D. Caines. 2000. Status of the Atlantic salmon (*Salmo salar* L.) stock of Harry's River/Pinchgut Brook, Newfoundland, 1999.

19. Mullins, C. C. and D. Caines 2000. Status of the Atlantic salmon (*Salmo salar* L.) stock of Humber River, Newfoundland, 1999.

20. Porter. T. R. 2000. Status of Atlantic salmon (*Salmo salar* L.) populations in Crabbes and Robinsons Rivers, and Middle Barachois, Fischells and Flat Bay Brooks, Newfoundland, 1999.

21. Dempson, J. B. and M. Shears. 2000. Status report for northern Labrador Arctic charr, 1999.

22. Mullins, C.C., and D. Caines. 2000. Status of the Atlantic salmon (*Salmo salar*) stocks of Lomond River, Torrent River, and Western Arm Brook, Newfoundland, 1999.

23. Porter, T. R. 2000. Observations of rainbow trout in Newfoundland.

24. O'Connell, M. F. General stock status of Atlantic salmon in Newfoundland, SFAs 3-14A

Appendix 5
Summary of Atlantic salmon stock status

Summary of Atlantic salmon stock status in the Newfoundland Region. Conservation met refers to the actual percentage of the conservation spawning requirement achieved, but is intended as a reference level only for Labrador stocks. Refer to footnotes for definition of characters and abbreviations.

Region / River	SFA	Map Index	Method	Total Returns in 1999 Small	Total Returns in 1999 Large	Conservation met (%) 1995	1996	1997	1998	1999	1992 - 1999	Status in 1999: Smolts Relative to 1998	Smolts Relative to 1992 - 98	Marine Survival Relative to 1998	Marine Survival Relative to 1992 - 98	Egg Deposition Relative to 1998	Egg Deposition Relative to 1992 - 98
Labrador																	
English *	1	3	Fe	59	48												
Big Brook *	1	2	Fe	737	180			24		38	0 of 2 yrs					-	⇧
Paradise *	2	1	MR	4681	491					96	0 of 1 yrs						
Newfoundland																	
Northeast Coast																	
Exploits	4	1	Fw	28303	2239	39	69	24	48	50	0 of 8 yrs					⇔	⇧
Lower	4		Fw			121	210	72	146	146	7 of 8 yrs					⇔	⇧
Middle	4		Fw			24	43	15	35	35	0 of 8 yrs					⇔	⇧
Upper	4		Fw			12	26	10	6	7	0 of 8 yrs					⇔	⇩
Campbellton	4	2	Fe	3076	493	279	304	200	311	326	7 of 7 yrs	⇩	⇔	⇧	⇩	⇔	⇧
Gander	4	3	Fe	18401	482	95	124	62	110	121	5 of 8 yrs					⇔	⇧
Indian Bay Brook	5	4	Fe	2248	385			113	183	181	3 of 3 yrs					⇩	⇔
Middle Brook	5	5	Fw	1950	130	114	250	198	306	227	8 of 8 yrs					⇩	⇧
Terra Nova River	5	6	Fw	1952	343	45	38	32	32	34	0 of 8 yrs					⇔	⇔
Northwest Brook (Port Blandford)	5	7	Fe	314	93	37	55	46	42	28	0 of 5 yrs					⇩	⇩

Assessment methods: Fe = counting fence; Fw = fishway count; Sc = snorkel count; MR = Mark-recapture

Trend symbols: ⇩ > 10% decrease; ⇧ > 10% increase; ⇔ no change = ± 10%

Map index numbers refer to text figure and legend

Marine survival is from smolts in year i to small salmon in year i + 1

* Use of 240 eggs/100 m2 as a conservation requirement for Labrador rivers may not be appropriate, and is used here only as a reference level

Appendix 5 - Continued

Summary of Atlantic salmon stock status

Summary of Atlantic salmon stock status in the Newfoundland Region. Conservation met refers to the actual percentage of the conservation spawning requirement achieved, but is intended as a reference level only for Labrador stocks. Refer to footnotes for definition of characters and abbreviations.

Region / River	SFA	Map Index	Method	Total Returns in 1999 Small	Total Returns in 1999 Large	Conservation met (%) 1995	1996	1997	1998	1999	1992 - 1999	Status in 1999: Smolts Relative to 1998	Smolts Relative to 1992 - 98	Marine Survival Relative to 1998	Marine Survival Relative to 1992 - 98	Egg Deposition Relative to 1998	Egg Deposition Relative to 1992 - 98
Newfoundland																	
South Coast																	
Northeast Brook (Trepassey)	9	8	Fe	95	18	194	196	135	256	246	8 of 8 yrs	↓	↓	⇔	↓	⇔	⇧
Rocky River	9	9	Fe	377	77	56	34	56	54	39	0 of 8 yrs	↓	↓	⇧	↓	↓	⇔
Northeast River (Placentia)	10	10	Fw	363	167	422	736	486	484	269	8 of 8 yrs					↓	↓
Little River	11	11	Fe	307	49												
Conne	11	12	Fe	2357	241	147	204	125	150	122	6 of 8 yrs	⇔	↓	⇧	↓	↓	⇔
Southwest Coast																	
Highlands	13	13	Fe	141	72	67	79	105	59	49	1 of 7 yrs	⇧	⇔	⇧	⇧	↓	↓
Crabbes	13	14	Sc	686	264		68	95	44	55	0 of 7 yrs					⇧	⇧
Middle Barachois	13	15	Sc	565	67		52	97		44	0 of 6 yrs					-	↓
Robinsons	13	16	Sc	1431	203		67	91		117	1 of 6 yrs					-	⇧
Fischells	13	17	Sc	1264	246			44	23	110	1 of 6 yrs					⇧	⇧
Flat Bay	13	18	Sc	2261	235	45	85	89		149	1 of 7 yrs					-	⇧
Harrys	13	19	Fe	1643	171	46	52	50	49	49	0 of 8 yrs					⇔	⇧
Humber	13	20	MR	27585	4433	126	166	115	120	201	6 of 8 yrs					⇧	⇧
Northwest Coast																	
Lomond	14A	21	Fw	1091	121	187	143	161	151	181	8 of 8 yrs					⇧	⇧
Torrent	14A	22	Fw	4330	411	1033	1279	797	924	680	8 of 8 yrs					↓	↓
Western Arm Brook	14A	23	Fe	1046	22	286	415	200	625	370	8 of 8 yrs	↓	↓	↓	⇔	↓	⇧

Assessment methods: Fe = counting fence; Fw = fishway count; Sc = snorkel count; MR = Mark-recapture

Trend symbols: ↓ > 10% decrease; ⇧ > 10% increase; ⇔ no change = ± 10%

Map index numbers refer to text figure and legend

Marine survival is from smolts in year i to small salmon in year i + 1

* Use of 240 eggs/100 m2 as a conservation requirement for Labrador rivers may not be appropriate, and is used here only as a reference level

Appendix 6

Summary Sheets

STOCK: **Big Brook (SFA 1)** **Drainage area:** 793 km² (accessible)

CONSERVATION REQUIREMENT: x million eggs (~ x small salmon) calculated as fluvial area x 2.4 eggs/m²

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	-	-	-	530	-	737	530	737
Large	-	-	-	104	-	180	104	180
Recreational harvest (small salmon)								
Retained	62	92	36	73	54	49	-	412
Released	22	21	12	32	24	41	-	41
Recreational harvest (large salmon)								
Retained	10	5	5	2	4	13	-	172
Released	1	0	0	1	2	9	-	9
Spawners								
Small	-	-	-	454	-	684	454	684
Large	-	-	-	102	-	166	102	166
Egg conservation requirement								
% met	-	-	-	24	-	38	24	38

[1] Min and max are for the period of record since 1974.
[2] Preliminary

Data and methodology: A complete count of the adult salmon migration was obtained from a portable fish counting fence in 1997 and 1999. A hook-and-release mortality rate of 10% was used in the calculation of spawning escapement. Recreational data comes from DFO angling statistics collected from the outfitting camp on the river and are preliminary for 1999. Egg requirements for fluvial habitat were calculated similar to other rivers in Eastern Canada, however, due to a lack of information on lacustrine rearing in Labrador, lacustrine habitat was not included in the calculation.

State of the stock: The percentage of conservation requirements achieved remains low. However, there is some doubt as to the applicability of the Eastern Canada conservation requirement of 240 eggs per m2 in Labrador. Risk analysis indicated that 95th confidence intervals for conservation requirements were 27 to 51%.

Forecast: No forecast is available.

STOCK: **Paradise River (SFA 2)** **Drainage area:** 5276 km² (accessible)

CONSERVATION REQUIREMENT: 13.542 x million eggs (~ x small salmon) calculated as fluvial area x 2.4 eggs/m²

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	-	-	-	-	-	4681	-	-
Large	-	-	-	-	-	491	-	-
Recreational harvest (small salmon)								
Retained	-	-	-	-	-	-	-	-
Released	-	-	-	-	-	-	-	-
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	-	-
Released	-	-	-	-	-	-	-	-
Spawners								
Small	-	-	-	-	-	4681	-	-
Large	-	-	-	-	-	491	-	-
Egg conservation requirement								
% met	-	-	-	-	-	96	-	-

[1] Min and max are for the period of record since 1974.
[2] Preliminary

Data and methodology: Returning salmon are estimated by mark-recapture (Petersen) and at a counting fence on a tributary. Paradise River is not a scheduled river and as such does not have any angling statistics. Locals who fish the river indicate that angling catch is very low probably. The Trans Labrador Highway is expected to bring increased access and exploitation to trout and salmon stocks in some southern Labrador rivers.

State of the stock: Conservation requirements were almost achieved in 1999.

Forecast: No forecast is available.

STOCK: **Exploits River (SFA 4)** **Drainage area:** 11,272 km²

CONSERVATION REQUIREMENT: 95.9 million eggs (equivalent to 56,670 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	17602	16226	30425	15263	27093	28802	4740	30425
Large	917	945	2057	881	1959	2236	343	2236
Recreational harvest (small salmon)								
Retained	3072	1336	1915	2996	2019	1951	577	3072
Released	1145	1531	3202	2169	3168	1092	1145	3202
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	0	83
Released	30	72	111	0	243	191	0	243
Broodstock removal	0	0	0	0	0	0	31	5111
Spawners [3]	15263	15613	30192	12859	26647	28842	2326	30192
Small			28147	11978	24717	26629		28146
Large			2045	881	1930	2213		2213
Fry Stocked	0	0	0	0	0	0	212610	6410426
Egg conservation requirement								
% met	31	39	69	24	48	50	6	69
Lower	103	121	210	72	146	146	34	210
Middle	18	24	43	15	35	35	8	43
Upper	7	12	26	10	6	7	0	119

[1] Min and max are for the period of record since 1974.
[2] Preliminary
[3] No's of large and small salmon are unavailable

Data and methodology: There are 35 million m2 units of fluvial habitat and 34,000 ha of lacustrine habitat. Conservation egg requirements are to come from small salmon. Previous fry releases are backcalculated to eggs for % of conservation egg deposition achieved in areas stocked. Total returns to the river are based on the count at Bishop Falls fishway plus angling below the fishway.

Broodstock requirements: None at present.

Recreational catches: The 1998 - 99 recreational fishery data on the Exploits River, is derived from the license stub return data.

State of the stock: Overall returns to the Exploits River, have improved during the moratorium years; however returns to the upper section of the watershed are extremely low and all efforts should be made to increase escapement to this section of the watershed.

Forecast: No quantitative forecast available

STOCK: **Campbellton River (SFA 4)** **Drainage area:** 296 km² (accessible)

CONSERVATION REQUIREMENT: 2.916 million eggs (~ 1,480 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	2857	3035	3208	1975	3275	3076	1975	4001
Large	191	218	560	321	402	493	145	560
Recreational harvest (small salmon)								
Retained	340	393	463	254	375	189	23	1547
Released	4	47	93	67	281	69	4	281
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	0	63
Released	1	1	31	9	8	12	0	31
Spawners								
Small	2517	2637	2736	1714	2872	2880	1714	3675
Large	191	218	557	320	401	492	145	557
Egg conservation requirement								
% met	239	279	304	200	311	326	200	326
Smolt count	41633	39715	58369	62050	50441	47256	31577	62050
% Sea survival								
(Adult return year)	7.2	6.1	7.2	2.3	4.9	5.0	2.3	7.2

[1] Min and max are for the period of record since 1974.
[2] Preliminary

Data and methodology: Smolts were enumerated at a counting fence. Returning adult salmon are enumerated at a fish counting fence with a video camera system. A hook-and-release mortality rate of 10% was used in the calculation of spawning escapements for the years 1993-99. Recreational data for 1997-99 were from the License Stub Return System and are preliminary. Sea survival is corrected to exclude previous spawners in the upstream migration. Previous spawners were estimated in 1999 from survival patterns in previous years. Egg conservation requirement met for 1998 was calculated using average percent female and average whole weight, 1993-98 due to the low number of samples obtained from the angling fishery. The 1999 egg conservation requirement used biological data collected in 1999.

State of the stock: Conservation requirements were met from 1993 to 1999.

Forecast: No forecast available.

STOCK: **Gander River (SFA 4)** **Drainage area:** 6,398 km²

CONSERVATION REQUIREMENT: 46.211 million eggs (21,828 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	18273	22266	23946	10599	18805	18491	6745	26205
Large	1072	1121	1753	1883	3649	4822	473	4822
Recreational harvest (small salmon)								
Retained	2122	2598	2974	1061	2543	2068	1061	4578
Released	448	612	1153	1007	2179	859	448	2179
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	13	927
Released	39	74	73	189	298	222	39	298
Spawners								
Small	16106	19606	20822	9437	16044	16337	5565	24739
Large	1068	1114	1746	1864	3619	4800	473	4800
Egg conservation requirement								
% met	91	95	124	62	110	121	36	128

[1] Min and max are for the period of record since 1974.
[2] Preliminary
Note: Any changes from previous years are due to the updating of preliminary data and biological characteristics information.

Recreational catches: The number of small salmon retained in 1999 was 2068 (a decrease of 19% from 1998) and the number released was 859 compared to 2179 in 1998.

Data and methodology: Complete counts of salmon were obtained at a fish counting fence during 1989-99, and have historically been counted at a fishway located on a tributary, Salmon Brook. Recreational fishery data for 1997-99 are from the License Stub Return System; data for 1999 are preliminary. Data for large salmon for 1997 are incomplete. A hook-and-release mortality of 10% was used in the calculation of total returns and spawning escapements for the years 1993-99.

State of the stock: Conservation requirement was achieved in 1999. Conservation egg requirement was achieved in five of the eight moratorium years. Conservation requirement in terms of small salmon was met only in 1993. Using Salmon Brook as an indicator of returns to the entire river, it is likely that returns of small salmon of a magnitude similar to or greater than those in 1992-99 occurred in pre-moratorium years.

Forecast: No forecast available.

STOCK: **Indian Bay Brook (SFA 5)** **Drainage area:** 703 km²

CONSERVATION REQUIREMENT: 4.6 million eggs (~ 2,055 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small				1439	2716	2248	1439	2716
Large				353	336	365	336	365
Recreational harvest (small salmon)								
Retained	589	683	551	205	315	260	205	893
Released	171	288	36	57	188	52	36	288
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	0	6
Released	1	0	0	15	4	12	0	15
Spawners								
Small				1228	2383	1983	1228	2383
Large				351	336	364	336	364
Egg conservation requirement								
% met	-	-	-	113	183	161	113	183

[1] Min and max are for the period of record since 1974.
[2] Preliminary

Recreational catches: In 1999, a total of 260 small salmon was retained and 52 were released.

Data and methodology: Complete counts are available from a fish counting fence, which operated in 1997-99. Recreational fishery data for 1997-99 are from the Llicense Stub Return System; data for 1999 are preliminary. A hook-and-release mortality of 10% was used in the calculation of total returns and spawning escapements.

State of the stock: As was the case for 1998, conservation requirement in terms of eggs and small salmon was achieved in 1999. The conservation requirement for small salmon was not reached in 1997.

Forecast: No forecast available.

STOCK: **Middle Brook (SFA 5)** **Drainage area:** 276 km²

CONSERVATION REQUIREMENT: 2.3 million eggs (~ 1,012 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	1844	1448	2112	1287	2549	1950	626	2549
Large	90	168	161	262	196	130	13	262
Recreational harvest (small salmon)								
Retained	409	402	476	77	188	141	28	789
Released	122	82	153	10	154	37	10	387
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	0	20
Released	0	0	0	1	17	14	0	37
Spawners								
Small	1423	1037	1605	1209	2345	1806	461	2345
Large	90	168	161	262	195	129	13	262
Egg conservation requirement								
% met	174	114	250	196	301	227	49	301

[1] Min and max are for the period of record since 1974.
[2] Preliminary
Note: Any changes from previous years are due to the updating of preliminary data and biological characteristics information.

Recreational catches: A total of 141 small salmon was retained in 1999 and 37 were released.

Data and methodology: Complete counts are available from a fishway located on the lower river. Recreational fishery data for 1997 were obtained from a creel survey and 1998-99 are from the License Stub Return System; data for 1999 are preliminary. A hook-and-release mortality of 10% was used in the calculation of total returns and spawning escapements for the years 1993-99.

State of the stock: Conservation requirement in terms of eggs and small salmon was exceeded in the moratorium years 1992-99. Egg deposition was below conservation requirement for pre-salmon moratorium years 1985-91. Counts of small salmon similar to or higher than those observed during the moratorium years occurred in pre-salmon moratorium years.

Forecast: No forecast available.

STOCK: **Terra Nova River (SFA 5)** **Drainage area:** 1,883 km²

CONSERVATION REQUIREMENT: 14.3 million eggs (~ 7,094 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	2035	2638	2575	1800	1815	1952	1127	3050
Large	246	638	472	528	390	343	56	638
Recreational harvest (small salmon)								
Retained	822	696	896	296	146	85	85	896
Released	178	132	260	148	379	125	125	569
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	0	43
Released	44	72	113	10	32	10	10	113
Broodstock removal [3]								
Small	64	222	225	352	270	239	64	352
Large	9	44	32	29	0	3	0	44
Spawners								
Small	1305	1835	1577	1137	1361	1615	815	2620
Large	232	587	429	498	387	339	56	587
Egg conservation requirement								
% met	26	45	36	32	32	34	14	53

[1] Min and max are for the period of record since 1974.

[2] Preliminary

[3] In 1994-99, a number of adults were removed as broodstock for an incubation facility for subsequent fry stocking back to Terra Nova River above Mollyguajeck Falls; these adults were deducted from spawning escapements on the calculation of percen of conservation requirement me presented above.

Note: Any changes from previous years are due to the updating of preliminary data and biological characteristics information.

Recreational catches: A total of 85 small salmon was retained in 1999 and 125 were released.

Data and methodology: Counts are available from a fishway located on the lower river. Recreational fishery data for 1997-99 are from the License Stub Return System; data for 1999 are preliminary. A hook-and-release mortality of 10% was used in the calculation of total returns and spawning escapements for the years 1993-99.

State of the stock: The proportion of conservation requirement achieved in 1999 was 34%. Although this river has never achieved conservation requirement, egg depositions during the moratorium years 1992-99 were generally higher than in pre-moratorium years. It should be noted that accessible rearing habitat for anadromous Atlantic salmon above the lower fishway more than doubled in 1985 with the opening of the area above Mollyguajeck Falls.

Forecast: No forecast available.

STOCK: **Northeast Brook, Trepassey (SFA 9)** **Drainage area:** 21 km²

CONSERVATION REQUIREMENT: 0.14 million eggs (~ 51 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	99	80	73	50	91	95	49	158
Large	15	12	15	9	11	18	9	41
Recreational harvest (small salmon)								
Retained	—— Closed to angling ——							
Released								
Recreational harvest (large salmon)								
Retained	—— Closed to angling ——							
Released								
Spawners								
Small	99	80	73	50	91	95	49	158
Large	15	12	15	9	11	18	9	41
Egg conservation requirement								
% met	239	194	196	135	256	248	126	368
Smolt count	944	792	1749	1829	1727	1419	792	1911
% Sea survival								
(Adult return year)	5.4	8.5	9.2	2.9	5.0	5.5	2.6	9.2

[1] Min and max are for the period of record since 1984.
[2] Preliminary

Data and methodology: Counts of adults and smolts have been available from a counting fence since 1984 and 1986. Up until a few years ago, this small system was part of a group of experimental rivers involved in research on stock-recruitment relationships and definition of smolt production in terms of various habitat types. The system has become an important indicator of smolt (year i) to (small salmon year i + 1) survival (repeat spawners included).

State of the stock: Conservation egg requirment has been met every year in the time series, but the lowest level achieved occurred in 1997. In terms of small salmon, the second lowest percentage of conservation requirement achieved also occurred in 1997. The maximum number of smolts counted was 1,911 in 1991 while the lowest was 792 in 1995. Highest sea survival prior to the commercial salmon-fishing moratorium (8.1%) was recorded in 1987. Lowest survival (2.6%) occurred in 1992. Since the start of the moratorium in 1992, sea survival rose to a peak of 9.2% in 1996 only to plummet to 2.9% in 1997; an improvement over this low was noted for 1998 and continued in 1999.

Forecast: No forecast available.

STOCK: **Rocky River (SFA 9)** **Drainage area:** 296 km²

CONSERVATION REQUIREMENT: 3.4 million eggs (~ 881 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	158	385	356	435	423	327	80	435
Large	19	39	45	89	130	77	1	89
Recreational harvest (small salmon)								
Retained	—— Closed to angling ————							
Released								
Recreational harvest (large salmon)								
Retained	—— Closed to angling ————							
Released								
Broodstock removal	62	76	0	0	0	0	0	76
Spawners								
Small	96	309	355	435	423	327	158	435
Large	17	39	45	89	130	77	1	89
Fry stocked	0	81983	162231	0	0	0	81983	434500
Egg conservation requirement								
% met	25	56	34	56	54	39	17	56
Smolt count	9781	7577	14261	16900	12163	8625	5115	16900
% Sea survival								
(Adult return year)	2.3	3.4	4.2	2.8	2.2	1.8	2.3	4.2

[1] Min and max are for the period of record since 1987.
[2] Preliminary

Background: Rocky River was stocked with salmon fry from 1983 to 1987 with the first returns to the reconstructed fishway realized in 1987. Also in 1987 140 adult salmon were transferred into Rocky River from Little Salmonier River.

Data and Methodology: Fluvial habitat consists of 1.08 million m2 and lacustrine habitat includes 2200 ha. Biological characteristics used in calculations are those for Rocky River stock. Previous fry releases are backcalculated to eggs for % of target egg achieved in areas stocked. Complete adult counts are available from a trap installed in the fishway. Smolts have been enumerated annually since 1990. Sea survival is smolt to 1SW salmon returns to the fishway..

Recreational fisheries: The recreational fishery is closed on this river.

State of the stock: Stock is still in the development phase.

Forecast: There is no forecast for 2000.

STOCK: **Northeast River - Placentia (SFA 10)** **Drainage area:** 94 km²

CONSERVATION REQUIREMENT: 0.72 million eggs (~ 224 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	710	774	1420	723	885	363	350	1420
Large	70	74	123	185	287	187	0	287
Recreational harvest (small salmon)								
Retained	39	127	268	95	201	52	19	349
Released	5	8	7	45	102	19	5	189
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	0	6
Released	0	0	0	33	23	8	0	33
Broodstock removal [3]								
Small	-	-	-	31	51	43	31	51
Large	-	-	-	-	-	7	0	7
Spawners								
Small	670	646	1102	592	622	266	317	1102
Large	70	74	123	182	285	159	0	285
Egg conservation requirement								
% met	434	422	736	486	484	269	152	736

[1] Min and max are for the period of record since 1974.

[2] Preliminary

[3] In 1997-99 small salmon (numbering 31, 51, and 43 respectively) were removed as broodstock for enhancement projects in Rennie River and Waterford River, St. John's, and for research pruposes at the Ocean Sciences Centre.

Note: Any changes from previous years are due to the updating of preliminary data and biological characteristics information.

Recreational catches: In 1999, a total of 52 small salmon was retained and 19 were released.

Data and methodology: Counts are available from a fishway on the lower river. Recreational fishery data for 1997-99 are from the License Stub Return System; data for 1999 are preliminary. A hook-and-release mortality of 10% was used in the calculation of total returns and spawning escapements for the years 1993-99.

State of the stock: Conservation requirement has been exceeded every year since 1984. The return of small salmon in 1999 was the lowest of the moratorium years.

Forecast: No forecast available.

STOCK: **Little River (SFA 11)** **Drainage area:** 183 km²

CONSERVATION REQUIREMENT: 0.306 million eggs (~ 230 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	73	118	674	399	264	307	55	674
Large	11	17	127	79	49	49	3	127
Recreational harvest (small salmon)								
Retained	—— Closed to angling in 1989 ———							
Released								
Recreational harvest (large salmon)								
Retained	—— Closed to angling in 1989 ———							
Released								
Broodstock removal								
Small	0	80	118	0	-	116	0	118
Large	0	5	1	0	-	256	0	6
Spawners								
Small	73	33	538	386	-	57	13	538
Large	11	12	125	78	-	31	3	125
Fry stocked	118472	0	92528	145921	0	306180	20070	145921
Egg conservation requirement								
% met	37	56	288	200	231	38	29	288
Smolt count	501	2712	4449	2521	3320	1177	324	4449

[1] Min and max are for the period of record since 1987.
[2] Preliminary

Data and methodology: Conservation egg deposition is derived for accessible habitat (1,306 riverine units). Biological characteristics used in calculations are those for salmon from Little River and Conne River. Current fry releases are backcalculated to eggs for % of conservation egg achieved in areas stocked. Total returns to the river are based on fence counts.

Recreational catches: The recreational fishery was closed in 1989 and the only angling statistics for the river predate 1975.

State of the stock: The stock size appears to be increasing.

Forecast: There is no forecast for 2000.

STOCK: **Conne River (SFA 11)** **Drainage area:** 602 km²

MANAGEMENT TARGET: 7.8 million eggs (~ 4,000 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to home waters								
Small	1533	3502	4440	3200	2931	2358	1533	10155
Large	100	110	179	185	295	241	89	516
First Peoples' harvest								
Small	0	0	0	514	0	0	0	948
Large	0	0	0	1	0	0	0	11
Recreational harvest (small salmon)								
Retained	-	-	-	197	-	-	108	3302
Released	-	-	-	80	-	-	0	80
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	0	27
Released	-	-	-	0	-	-	0	0
Broodstock removal								
Small	93	117	25	0	0	0	25	245
Large	1	0	0	0	0	0	0	1
Spawners								
Small	1435	3376	4402	2558	2926	2349	1435	7823
Large	99	108	179	182	294	240	87	488
Management Target								
% met	40	82	114	70	84	68	40	214
Smolt estimate	60762	62749	94088	100983	69841	63658	55765	100983
% Sea survival (Adult return year)	2.7	5.8	7.2	3.4	2.9	3.4	2.7	10.2

[1] Min and max are for the period of record since 1974. First Peoples' harvest in salt water includes some salmon from other rivers. First Peoples' fishery quota of 1200 fish has been in effect since 1996, but was reduced to 500 fish for 1998. First Peoples' fishery and recreational fishery were closed again in 1998 and 1999.
[2] Preliminary

Data and methodology: Smolt estimates are derived from mark-recapture surveys. Returning adult salmon are enumerated at a fish counting fence. Angling harvets for Conne River are from DFO statistics. A video camera system was introduced in 1993.

State of the stock: The Management Target, which is higher than the conservation egg requirement, was met from 1986 to 1990 and again in 1996. Only 40-61% of the target was achieved from 1991-1994, rose to 81% in 1995 and was 68% in 1999. Sea survival to small salmon increased to 3.4% from 2.9% in the previous year. In contrast with the Mangement Target, the Conservation egg requirement was met or exceeded from 1986-1990, in 1993, and again from 1995 - 1999.

Forecast: Based upon the point estimate of the number of smolts that migrated in 1999, a marine survival rate of 3.9% would be required in order for the conservation requirement to be attained in 2000, while a survial of 6.3% would be needed to meet the Management Target. Both values are higher than that observed during the past three years.

STOCK: **Highlands River (SFA 13)** **Drainage area:** 183 km²

CONSERVATION REQUIREMENT: 1.5 million eggs calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to home waters								
Small	145	172	199	398	96	146	82	398
Large	148	120	142	157	117	82	29	157
Recreational harvest (small salmon)								
Retained	—— Closed to angling since 1978 ————							
Released								
Recreational harvest (large salmon)	—— Closed to angling since 1978 ————							
Retained								
Released								
Spawners								
Small	145	172	199	398	96	146	82	398
Large	148	120	142	157	117	82	29	157
Conservation requirement								
% met	77	67	79	105	59	49	28	105
Smolt count	10503	12160	12383	6776	5922	9634	5922	15839
% Sea survival								
Small	1.5	1.6	1.6	3.2	1.4	2.5	0.6	3.2
Large (Adult return year)	-	1.2	1.4	1.3	0.9	1.2	0.4	1.4

[1] Min and max are for the period of record since 1974.
[2] Preliminary

Data and methodology: Counts of smolt and adult salmon were obtained with a fish counting fence in 1980 - 82 and in 1993 - 99. Juvenile salmon densities were measured at 5 stations in 1999 to determine changes in juvenile salmon production. Sea survival is calculated for small salmon returning in year i + 1 and for large salmon returning in year i + 2, by dividing the number of returning adults by the number of smolts in year i.

State of the stock: The number of large salmon returning has increased since the closure of the commercial salmon fishery in 1992, but has fallen in each of the past two years since the peak in 1997. Small salmon returns are variable. The conservation spawning requirement was achieved in only one year (1997) and fell to below 50% of the requirement in 1999.

Forecast: The conservation spawning requirement will likely not be met in 2000 unless there is a corresponding increase in marine survival rates. Based upon the average egg deposition contribution from small and large salmon, respectively, over the past 7 years (1993 - 1999), marine survival rates approximating 2.7% for small salmon returns from the 1999 smolt class and 3.0% survival for large salmon returns from the 1998 smolt class would be required. To date, the highest survival to large salmon has been only 1.35%.

STOCK: **Crabbes River (SFA 13)** **Drainage area:** 551 km²

CONSERVATION REQUIREMENT: 4.6 million eggs (spawners not defined) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	774	N/A	866	1152	491	686	111	1916
Large	113	N/A	249	358	177	264	15	397
Recreational harvest (small salmon)								
Retained	174	26	-	3	-		26	561
Released	37	5	221	278	91	29	0	278
Recreational harvest (large salmon)								
Retained	-		-	-	-	-	14	127
Released	45	32	96	119	55	12	0	119
Spawners								
Small	600	N/A	844	1121	482	683	64	1355
Large	113	N/A	239	346	171	263	15	346
Egg conservation requirement								
% met	41	N/A	68	95	44	65	3	95

[1] Min and max are for the period of record since 1974.
[2] Preliminary

Data and methodology: Visual counts of salmon were made by snorkellers in late August, 1996 to 1999. An adjustment factor was applied to the visual counts to give an estimate of the total number of salmon in the river. In 1994, the assessment was based on applying an angling exploitation rate to the recreational catches. Angling data prior to 1996 were collected by River Guardians. In 1996-99 angling catches are from the License Stub Return System. A 10% hook-and-release mortality was assumed.

State of the stock: In 1999, Crabbes River achieved 65% of its egg deposition required for conservation. The estimate is higher than the egg deposition in 1998, but slightly below the 1996-98 average (69%). The egg deposition appears to have increased since 1993, although it is still below spawning requirements.

Forecast: There is insufficient information available to forecast the abundance of Atlantic salmon in 2000.

STOCK: **Middle Barachois Brook (SFA 13)** **Drainage area:** 241 km²

CONSERVATION REQUIREMENT: 2.1 million eggs (spawners not defined) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	732	N/A	825	1060	N/A	559	134	1619
Large	81	N/A	40	190	N/A	67	0	1159
Recreational harvest (small salmon)								
Retained	154	53	-	-	-	-	51	534
Released	25	2	195	158	6	33	0	195
Recreational harvest (large salmon)								
Retained	-		-	-	-	-	0	117
Released	14	24	35	81	23	6	0	81
Spawners								
Small	578	N/A	805	1044	N/A	556	83	1329
Large	81	N/A	36	182	N/A	66	0	1057
Egg conservation requirement								
% met	74	N/A	52	97	N/A	44	9	254

[1] Min and max are for the period of record since 1974.
[2] Preliminary

Data and methodology: Visual counts of salmon were made by snorkellers in late August, 1996, 1997 & 1999. Adjustment factors were applied to visual counts to give estimates of the total numbers of salmon in the river. In 1994, the assessment was based on applying an angling exploitation rate to the recreational catches. Angling data prior to 1996 were collected by River Guardians. In 1996-99 angling catches are from the License Stub Return System. A 10% hook-and-release mortality was assumed.

State of the stock: In 1999, Middle Barachois Brook achieved 44% of its egg deposition required for conservation. The estimate is lower than the egg deposition in 1997 and 1996. The low abundance of salmon may be attributed to mortality of juveniles caused by the severe flood in February 1996.

Forecast: There is insufficient information available to forecast the abundance of Atlantic salmon in 2000.

STOCK: **Robinsons River (SFA 13)** **Drainage area:** 439 km²

CONSERVATION REQUIREMENT: 3.3 million eggs (spawners not defined) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	910	N/A	866	1077	N/A	1431	274	3186
Large	115	N/A	137	190	N/A	203	21	733
Recreational harvest (small salmon)								
Retained	160	73	5	3	4	-	3	905
Released	88	38	926	571	468	320	0	926
Recreational harvest (large salmon)								
Retained	-		-	-	-	-	0	210
Released	38	23	168	184	114	37	7	184
Spawners								
Small	750	N/A	768	1017	N/A	1399	158	2281
Large	115	N/A	120	172	N/A	199	21	604
Egg conservation requirement								
% met	65	N/A	67	91	N/A	117	9	174

[1] Min and max are for the period of record since 1974.
[2] Preliminary

Data and methodology: Visual counts of salmon were made by snorkellers in late August, 1996, 1997 & 1999. Adjustment factors were applied to visual counts to give estimates of the total numbers of salmon in the river. In 1994, the assessment was based on applying an angling exploitation rate to the recreational catches. Angling data prior to 1996 were collected by River Guardians. In 1996-99 angling catches are from the License Stub Return System. A 10% hook-and-release mortality was assumed.

State of the stock: In 1999, Robinsons River achieved 117% of its egg deposition required for conservation. The estimate is the highest estimated to have occurred since 1982. There has been an increasing trend in population size since 1993.

Forecast: There is insufficient information available to forecast the abundance of Atlantic salmon in 2000.

STOCK: **Fischells River (SFA 13)** **Drainage area:** 350 km²

CONSERVATION REQUIREMENT: 3.6 million eggs (spawners not defined) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	1060	N/A	N/A	797	215	1264	42	1276
Large	158	N/A	N/A	86	72	246	0	455
Recreational harvest (small salmon)								
Retained	216	80	315	182	17	-	17	374
Released	58	112	232	162	36	-	0	162
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	0	66
Released	47	43	150	127	4	-	0	150
Spawners								
Small	844	N/A	N/A	599	194	1264	25	1264
Large	158	N/A	N/A	73	72	246	0	415
Egg conservation requirement								
% met	71	N/A	N/A	44	23	110	1	110

[1] Min and max are for the period of record since 1974.
[2] Preliminary

Data and methodology: Visual counts of salmon were made by snorkellers in late August, 1997, 1998 & 1999. Adjustment factors were applied to visual counts to give estimates of the total numbers of salmon in the river. In 1994, the assessment was based on appiying an angling exploitation rate to the recreational catches. Angling data prior to 1996 were collected by River Guardians. In 1996-99 angling catches are from the License Stub Return System. A 10% hook-and-release mortality was assumed.

State of the stock: In 1999, Fischells River achieved 110% of its egg deposition required for conservation. The estimate is the highest recorded. There was a considerable increase in abundance from that observed in 1997 and 1998.

Forecast: There is insufficient information available to forecast the abundance of Atlantic salmon in 2000.

STOCK: **Flat Bay Brook River (SFA 13)** **Drainage area:** 635 km²

CONSERVATION REQUIREMENT: 3.8 million eggs (spawners not defined) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	420	650	1233	1307	N/A	2261	179	2261
Large	70	48	132	173	N/A	235	5	235
Recreational harvest (small salmon)								
Retained	128	-	-	-	-	-	0	609
Released	8	-	-	253	131	235	0	253
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	0	59
Released	32	-	-	57	89	35	0	89
Spawners								
Small	243	567	1051	1282	N/A	2237	107	2237
Large	67	44	112	167	N/A	231	1	231
Fry stocked	0	56059	127200	149555	0	0	56059	149555
Egg conservation requirement								
% met	19	45	85	89	N/A	149	4	149

[1] Min and max are for the period of record since 1974.
[2] Preliminary

Data and methodology: Visual counts of salmon were made by snorkellers in late August 1996, 1997 & 1999. Adjustment factors were applied to visual counts to give estimates of the total numbers of salmon in the river. In 1994 and 1995, the assessment was based on the count of salmon at a fish counting fence and angling data. Angling data prior to 1996 were collected by River Guardians. In 1996-99 angling catches are from the License Stub Return System. A 10% hook-and-release mortality was assumed.

State of the stock: In 1999, Flat Bay Brook achieved 149% of its egg deposition required for conservation. The estimate is the highest recorded since 1962. There appears to have been an increasing trend in abundance since 1994.

Forecast: There is insufficient information available to forecast the abundance of Atlantic salmon in 2000.

STOCK: **Harrys River (SFA 13)** **Drainage area:** 816 km²

CONSERVATION REQUIREMENT: 7.8 million eggs calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	1494	1982	1974	1718	1625	1655	864	1982
Large	116	72	137	198	187	175	15	198
Recreational harvest (small salmon)								
Retained	153	149	34	2	-	-	2	1008
Released	84	60	1196	591	288	116	23	1196
Recreational harvest (large salmon)								
Retained	-		-	-	-	-	1	68
Released	50	44	206	139	95	42	0	206
Spawners								
Small	1333	1827	1820	1657	1596	1643	518	1827
Large	111	68	116	184	177	171	12	184
Egg conservation requirement								
% met	46	48	52	50	49	49	12	52
Spawners on Pinchgut Brook tributary								
Small	544	749	601	613	593	608	212	749
Large	47	28	38	68	63	63	5	68

[1] Min and max are for the period of record since 1974.
[2] Preliminary
Note: Any changes from previous reports are due to the updating of preliminary data and biological characteristics information.

Recreational catches: The fishery has been limited to catch and release angling since 1996. The number salmon angled in 1999 was lower than in 1998 but this may have been due to inseason closures due to low water levels.

Data and methodology: Counts of small and large salmon were obtained at a fish counting fence operated on Pinchgut Brook tributary in 1992-99. Spawners on Harrys River were derived from spawning escapements above the counting fence adjusted for the percentage of the total spawning activity observed on Pinchgut Brook tributary during surveys conducted in the fall of 1995-97. Recreational fishery data for 1996-99 are from the License Stub Return System; data for 1999 are preliminary. A hook-and-release mortality of 10% was used in the calculation of total returns and spawning escapements for the years 1993-99.

State of the stock: Conservation requirement was not achieved in 1999. The stock has shown some signs of improvement since 1992 with increased juvenile densities and proportion of large salmon but it has been at most 52% of the conservation requirement. The low water levels experienced in recent years, incidence of poaching and the unknown effects of forest spraying and other human activity in the area create continued uncertainty for the stock in the short-term.

Forecast: No forecast available.

STOCK: **Humber River (SFA 13)** **Drainage area:** 7,679 km²

CONSERVATION REQUIREMENT: 28.3 million eggs (~ 15,749 small and 934 large salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [2]	MIN [1]	MAX [1]
Total returns to river								
Small	7995	27898	30445	14866	13016	27585	5724	30445
Large	1030	2064	2679	2595	4865	4433	401	4865
Recreational harvest (small salmon)								
Retained	2523	5150	4740	2447	1765	2223	804	5150
Released	1438	1881	3016	1433	2270	899	53	3016
Recreational harvest (large salmon)								
Retained	-		-	-	-	-	27	303
Released	166	233	237	133	618	689	10	689
Spawners								
Small	5328	22560	25404	12276	11024	25272	4293	25404
Large	1013	2041	2655	2582	4803	4364	400	4803
Egg conservation requirement								
% met	40	128	186	115	120	201	27	201

[1] Min and max are for the period of record since 1974
[2] Preliminary

Recreational catches: Total retained plus released catches of small salmon remained stable since 1992 but released catches of large salmon increased. The number of small salmon retained in 1999 was 26% higher than in 1998 but the released catch was 60% lower. This may have been due the removal of split season restrictions and the increased retention limit introduced in 1999. The number of large salmon released in 1999 was the highest recorded. A fall hook-and-release fishery was permitted below Deer Lake from 8 September to 7 October 1999, 8-27 September 1998 and 2-30 September 1997. The fishery produced one small and 27 large salmon for 172 rod days in 1997. However, catch statistics were not available for 1998-99.

Data and methodology: Total returns of small salmon to the river in 1999 were based on a mark-recapture technique using a recapture trap for tag recoveries. Total returns in 1990-98 were also based on mark-recpature but with tag recoveries from the recreational fishery. Returns of large salmon in 1999 were determined from returns of small salmon based on the ratio of large to small salmon observed in the recapture trap. In 1990-98 the ratio of large to small salmon in the marking traps was used. Recreational fishery data for 1998-99 are from the License Stub Return System; data for 1999 are preliminary. Recreational catches of small salmon prior to 1998 were based on angler surveys. Retained catches based on angler surveys were within 10% of those based on licence stub returns in 1996-98. Released catches of large salmon were from anglers surveys in 1997 and from DFO catch statistics prior to 1997. A hook-and-release mortality of 10% was used in the calculation of spawning escapements.

State of the stock: The conservation requirement was achieved on the river in 1999. The percentage achieved was 201% (95% CI=140-290). This was higher than in 1998, the highest since 1992 and the highest of the pre-moratorium years assessed. Returns of small salmon in 1999 were more than twice as high as in 1998 and the third highest since 1992. Returns of large salmon were 9% lower than in 1998 but were the second highest since 1992.

Management Considerations: The mark-recapture technique used in 1999 was very successful and eliminated some of the uncertainty associated with techniques used in previous assessments. However, some uncertainty still exists and a precautionary approach in controlling fisheries harvests on this stock is still warranted. Based on the 1996 assessment, the fall run of large salmon to the Lower Humber River consists of 2SW and 3SW salmon and previous spawners. The assessment suggests that the population size has increased in recent years. However, the population size appears to be low, probably less than 600 salmon. The 3SW component is unique to Newfoundland rivers and should be given special protection to minimize and to prevent any increase in fishing mortality.

Forecast: No forecast available.

STOCK: **Lomond River (SFA 14A)** **Drainage area:** 470 km²

CONSERVATION REQUIREMENT: 1.1 million eggs (~ 658 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [3]	MIN [1]	MAX [1]
Total returns to river [2]								
Small	1038	1365	982	1307	766	1091	259	1365
Large	56	101	98	77	128	121	3	128
Recreational harvest (small salmon)								
Retained	325	343	371	490	201	253	158	650
Released	116	190	99	273	226	93	24	273
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	2	34
Released	58	62	49	52	23	83	2	83
Known removals above fishway								
Small	6	20	0	0	1	10	0	22
Large	1	0	0	0	1	3	0	3
Spawners								
Small	695	983	601	783	541	819	1	983
Large	49	95	93	72	125	110	0	125
Egg conservation requirement								
% met	142	187	143	161	151	181	31	187

[1] Min and max are for the period of record since 1974.
[2] Total returns are approximate because of spawning below the fishway.
[3] Preliminary.
Note: Any changes from previous reports are due to the updating of preliminary data and biological characteristics information.

Recreational catches: The river quota that was in place since 1986 was dropped in 1999. The number of small salmon retained in 1999 was 26% higher than in 1998 but the released catch was 59% lower. This may have been due the removal of split season restrictions and retention limit changes introduced in 1999. The number of large salmon released in 1999 was the highest recorded.

Data and methodology: Returns to the river above the fishway are determined from counts at the fishway and recreational catch data below the fishway. With the exception of 1968-70 and 1989-91 the fishway has been monitored since 1961. Recreational fishery data for 1997-99 are from the License Stub Return System and are preliminary. A hook-and-release mortality of 10% was used in the calculation of spawning escapements for the years 1985-99.

State of the stock: The conservation requirement above the fishway was achieved in 1999. The percentage achieved was the second highest on record. Returns of small salmon in 1999 were 42% higher than in 1998. Returns of large salmon in 1999 were the second highest on record. The area above the fishway represents about 40% of the total river area. Using the area above the fishway as an indicator, this river has achieved the conservation requirement every year since the commercial salmon fishery moratorium.

Forecast: No forecast available.

STOCK: **Torrent River (SFA 14A)** **Drainage area:** 619 km²

CONSERVATION REQUIREMENT: 1.5 million eggs (~ 656 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 368 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [3]	MIN [1]	MAX [1]
Total returns to river [2]								
Small	3827	6168	7371	4033	5329	4330	96	7371
Large	332	615	509	674	766	411	7	766
Recreational harvest (small salmon)								
Retained	227	331	421	327	275	293	31	477
Released	82	369	270	469	552	293	75	469
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	2	34
Released	9	36	20	79	89	120	0	120
Spawners								
Small	3592	5800	6923	3659	4999	4008	121	6923
Large	331	611	507	666	757	399	3	757
Egg conservation requirement								
% met	530	1033	1279	797	924	680	161	1279

[1] Min and max are for the period of record since 1974.
[2] Total returns are approximate because of spawning below the fishway.
[3] Preliminary.
Note: Any changes from previous reports are due to the updating of preliminary data and biological characteristics information.

Recreational catches: The restriction of hook-and-release angling only until a minmum spawning escapement of 750 salmon had passed through the fishway was dropped in 1999. Catches and have increased over time with the highest values occurring since 1992. The number of small salmon retained in 1999 was 6% higher than in 1998 but the released catch was 47% lower. This may have been due the removal of split season restrictions and retention limit changes introduced in 1999. The number of large salmon released in 1999 was the highest recorded.

Data and methodology: Returns to the river above the fishway are determined from counts at the fishway and recreational catch data below the fishway. The fishway has been monitored since 1966. Recreational fishery data for 1997-99 are from the License Stub Return System and are preliminary. A hook-and-release mortality of 10% was used in the calculation of spawning escapements for the years 1985-99.

State of the stock: The conservation requirement was achieved above the fishway in 1999. The percentage achieved was lower in 1998 but similar to the 1992-98 mean. Returns of small salmon in 1999 were 19% lower than in 1998. Returns of large salmon were 46% lower than in 1998. Returns to Torrent River have shown an increasing trend since the late 1970s with the highest returns occurring since 1992. It is estimated that the Torrent River stock has achieved conservation requirement every year since 1978. This is due to the successful enhancement program carried out in 1972-76 when adult salmon were used to colonize above the fishway.

Forecast: No forecast available.

STOCK: **Western Arm Brook (SFA 14A)** **Drainage area:** 149 km²

CONSERVATION REQUIREMENT: 0.91 million eggs (~ 292 small salmon) calculated as fluvial area x 2.4 eggs/m² and lacustrine area x 105 eggs/ha

Year	1994	1995	1996	1997	1998	1999 [3]	MIN [1]	MAX [1]
Total returns to home waters								
Small	954	823	1230	509	1718	1046	233	1718
Large	31	33	50	55	128	22	0	128
Recreational harvest (small salmon)								
Retained	-	-	-	-	-	-	0	171
Released	-	-	-	-	-	-	-	-
Recreational harvest (large salmon)								
Retained	-	-	-	-	-	-	0	2
Released	-	-	-	-	-	-	0	2
Known removals above counting fence								
Small	0	27	41	1	68	1	0	223
Large	0	3	2	0	0	0	0	3
Spawners								
Small	954	796	1189	508	1650	1045	117	1650
Large	31	30	48	55	128	22	0	128
Egg conservation requirement								
% met	292	286	415	200	625	370	30	625
Smolt count	9283	15144	14502	23845	17139	13500	5735	23845
% Sea survival [2]								
(Adult return year)	6.8	8.9	8.1	3.0	6.6	6.1	2.1	12.0

[1] Min and max are for the period of record since 1974.
[2] Sea survival is from smolt to 1SW salmon returns in year of adult return.
[3] Preliminary
Note: Any changes from previous reports are due to the updating of preliminary data and biological characteristics information.

Recreational catches: The river has been closed to angling since 1989.

Data and methodology: Counts of smolts and adult salmon were obtained at a fish counting fence located at the mouth of the river in 1971-99. A hook-and-release mortality of 10% was used in the calculation of spawning escapements for the years 1985-89 when there was a recreational fishery.

State of the stock: The conservation requirement was achieved on the river in 1999. The percentage achieved was considerably lower than in 1998 but was higher than in any of the pre-moratorium years. Returns of small salmon in 1999 were 39% lower than in 1998 but the third highest since 1992. Returns of large salmon were down considerably from 1998 but were higher than in any of the pre-moratorium years. In spite of continued high egg depositions since the commercial fishery moratorium, smolt production has not continued to increase.

Forecast: The smolt production in 1999 was 21% less than in 1998. Hence, assuming that sea survival remains constant, returns of 1SW salmon in 2000 are expected to be lower than in 1999 but should be sufficient to achieve the conservation requirement. Given the variability in smolt sea survival in recent years, there is some uncertainty in this expectation.